WPS4300

Policy Research Working Paper 4300

Country Stakes in Climate Change Negotiations:

Two Dimensions of Vulnerability

Piet Buys
Uwe Deichmann
Craig Meisner
Thao Ton That
David Wheeler

The World Bank
Development Research Group
Sustainable Rural and Urban Development Team
August 2007

Abstract

Using a comprehensive geo-referenced database of indicators relating to global change and energy, the paper assesses countries' likely attitudes with respect to international treaties that regulate carbon emissions. The authors distinguish between source and impact vulnerability and classify countries according to these dimensions. The findings show clear differences in the factors that determine likely negotiating positions. This analysis and the resulting detailed, country level information help to explain the incentives required to make the establishment of such agreements more likely.

This paper—a product of the Sustainable Rural and Urban Development Team, Development Research Group—is part of a larger effort in the department to understand the implications and impacts of climate change. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Yvonne Edwards, room MC3-428, telephone 202-473-6308, fax 202-522-1151, email address yedwards@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at udeichmann@worldbank.org. August 2007. (95 pages)

Country Stakes in Climate Change Negotiations: Two Dimensions of Vulnerability

Piet Buys*
Uwe Deichmann*
Craig Meisner*
Thao Ton That**
David Wheeler***

* Development Research Group, World Bank, Washington D.C.
** UN Environment Programme, Geneva
*** Center for Global Development, Washington D.C.

Ken Chomitz, Ariel Dinar and Franck Lecocq provided helpful comments on an earlier draft of this paper. The views expressed here are the authors' and do not necessarily reflect those of the World Bank, its Executive Directors, or the countries they represent.

1. Introduction

Concern about global warming is escalating rapidly, and the international community has agreed to stabilize the concentration of greenhouse gases at a level that will prevent dangerous climate change. The next round of global negotiations seems likely to include developing countries. For their policymakers and negotiators, the sudden emergence of this issue raises several critical questions: Which countries are most vulnerable to climate change? How will the distribution of energy resources affect countries' willingness and ability to accept restrictions on their greenhouse emissions? Are renewable energy resources sufficient for a rapid transition from fossil fuel use? What are the implications of this transition for employment and the welfare of the poor?

This paper marshals the available data to provide tentative answers to these questions. We recognize that better information would be helpful, and that our results depend on a host of assumptions and estimates that can and should be challenged. To facilitate discussion, we provide a detailed appendix on data sources, assumptions, and computations. Despite these caveats, our results seem sufficiently robust that further refinement is unlikely to change two main conclusions. First, countries have very different stakes in this issue, regardless of their development levels. Their differences partly reflect their vulnerability to climate change impacts (we term this "impact vulnerability"): weather events and sea level rise. They also reflect sources of differential vulnerability to emissions reduction mandates ("source vulnerability"): access to fossil fuels and renewable energy sources, options for sequestering greenhouse emissions, and the potential size of employment and income shocks. Our results suggest that some countries have modest impact and source vulnerability, some have great vulnerability in both dimensions, and some are relatively vulnerable in one dimension but not the other. Logically, countries with high impact vulnerability and low source vulnerability should be most inclined to support greenhouse emissions limits. Conversely, countries with high source vulnerability and low impact vulnerability should be most resistant to such limits.

Our second major conclusion seems paradoxical, in light of the first. We find that potential supplies of clean energy are abundant, and that no physical or technical barrier prevents a transition from fossil fuels to renewable energy sources. Our results imply that the fundamental transition problems are political and institutional, rooted in the unfortunate magnitude of cross-country differences in impact and source vulnerability. We believe that a successful transition to clean energy sources will require recognition of differing country stakes and negotiation of compensation in two dimensions: transition support for countries with high source vulnerability, and adaptation support for countries with high impact vulnerability.

The rest of the paper is organized as follows. Section 2 frames the issue by analyzing cross-country differences in greenhouse emissions intensity and identifying the two critical dimensions of vulnerability. Section 3 explores two major elements of source vulnerability: access to fossil fuels and the structure of employment. In Section 4, we broaden the assessment of source vulnerability to include potential access to clean energy sources: solar, wind, hydro, geothermal and biofuels. In Section 5, we consider the potential role of sequestration options – reduced deforestation and underground storage -- in reducing source vulnerability. Section 6 considers the two primary dimensions of impact vulnerability: sea level rise and weather-related damage. Section 7 combines our evidence on source and impact vulnerability in an overall assessment of country stakes in climate change negotiations. In Section 8, we provide a summary and conclusions.

2. Carbon Emissions, Global Restrictions, and Two Dimensions of Vulnerability

Concern about global warming is relatively new, so most countries' greenhouse emissions intensities (emissions/output) are historical artifacts. The four basic determinants of intensity are energy efficiency (greenhouse emissions come disproportionately from energy production), the sectoral composition of the economy (some sectors are much more emissions-intensive than others), the fuel mix (fuels vary greatly in greenhouse intensity per unit of energy), and the collateral effects of local pollution regulation.[1] In developed economies, emissions intensity is reduced (ceteris paribus) by greater energy efficiency and the economic dominance of generally low-polluting service activities. However, this partial effect may be offset by other factors. Within many sectors (e.g. mining, manufacturing, agriculture (including land-clearing),

[1] Regulation of local pollution (e.g., SO_2, NO_x) reduces global pollution by shifting production and consumption away from fuels whose combustion is CO_2-intensive.

and transport), the activity mix and pollution intensity vary greatly with differences in subsectoral comparative advantage and politically-determined subsidies. Local factors also affect the emissions intensity of the fuel mix. Since fossil fuels are bulky and costly to transport, their delivered costs are strongly affected by relative proximity to extraction sites. This creates a strong incentive for fossil fuel use in countries with large, economically-exploitable deposits of coal, oil and natural gas. The same economic logic encourages greater use of clean, renewable energy sources (solar, wind, hydro, and geothermal) where their supply is plentiful.

As Table 1 shows, these factors produce great variations in country-level emissions intensities (tons of CO_2/\$10,000) in all income groups. Whatever their income levels, most countries fall within a common, broad range: 1.6 - 18.3 tons/\$10,000.[2] This point is reinforced by Table 2, which presents selected country matches by intensity in the lowest and highest income groups: Yemen/US (5.8 tons/\$10,000), Cote d'Ivoire/Finland (4.1), Pakistan/UK (3.9); Nigeria/Netherlands (3.2) and Kenya/Norway (3.1/3.2). For high-income countries, this pattern has clear political significance: It is no accident that the Kyoto Protocol has not been ratified by the United States and Australia, which have the highest emissions intensities among industrialized countries. Table 4 identifies an important source of their resistance: Australia ranks highest among all countries in coal resources relative to current energy consumption, and the US is the only other high-income economy in the top 10.

The ultimate significance of variations in national emissions intensities will depend on the pace of rising concern about global warming and the scope of a future protocol to limit emissions. Limiting overall emissions in a general protocol confronts all countries with an emissions "shadow price" in some form: an explicit tax, or an opportunity cost associated with a quantitative emissions limit. Relative emissions intensities provide robust indicators of country vulnerability in this context, because countries with higher emissions intensities per unit of output also face higher taxes or opportunity costs per unit of output. However, other protocols are possible. A plausible alternative would reduce global emissions by focusing on the largest emitters, regardless of their emissions intensities. Table 3 illustrates the potential for strategic targeting among developed and

[2] These are the highest minimum (Group 3) and lowest maximum (Group 4) observations, respectively.

developing countries. It displays total CO_2 emissions from countries that are above and below the international median per capita income. Overall, above-median countries emit 74% of the global total (16 billion tons), while below-median countries emit 26% (5.7 billion tons). Both groups have highly-skewed emissions patterns, particularly the below-median countries. China alone accounts for 49% of emissions in this group and India another 19%, while the top 10 emitters collectively account for 90%. Among above-median countries the largest emitter, the US, produces 33% of total emissions, while the top 10 emitters produce 69%. Overall, the pattern is clear: CO_2 emissions are so concentrated that major reductions in a few countries would effectively address the global problem.

Despite the abstract appeal of a targeted protocol, we do not believe that it is politically feasible. If it penalizes emissions, the largest emitters will refuse to absorb all the abatement costs while other economies remain untouched. Conversely, smaller emitters will reject the competitive implications of a protocol that promotes clean technology development only for the larger emitters. The Kyoto Protocol illustrates the force of this parity principle, since its binding provisions apply to both major emitters (e.g., Russia, Germany) and countries whose emissions make a negligible contribution to the total (e.g., Luxembourg). The parity principle seems likely to apply to future agreements as well, although large emitters may come under greater compliance scrutiny than small ones. In this paper, we therefore assume that a future international protocol to limit greenhouse emissions will apply to all countries.

We characterize the onset of this global protocol as a "shadow price shock," because an opportunity cost accompanies sudden limitation of access to a previously-free resource (the global atmosphere). Countries experience the shock via quantity restrictions, emissions taxes, or mandated support of cross subsidies (e.g., sequestration payments from emissions-intensive to low-polluting economies). The most vulnerable countries will have high dependence on domestic fossil fuel resources and few options for clean energy development. If the protocol includes sequestration payments, countries' vulnerability will be lower if they have high potential to sequester carbon. Conversely, vulnerability will be greater, particularly for the poor, if emissions-intensive economic sectors are also primary sources of employment.

These elements – emissions intensity, clean energy options, sequestration potential, and employment structure -- are all factors in determining one dimension of country vulnerability, which we term source vulnerability. As we will demonstrate in this paper, countries at all income levels exhibit great variation in all dimensions of source vulnerability.

Another type of vulnerability is, of course, the potential impact of climate change itself. Icecap melting and sea-level rise will disproportionately affect countries whose populations and economic activities are concentrated in coastal lowlands. Agriculturally-dependent economies will suffer particularly heavy losses as droughts increase. Some countries are prone to storm-related wind and flood damage, and storm severity is predicted to increase. All of these factors are components of the second dimension, which we label impact vulnerability.

We have no prior reason to believe that country vulnerabilities in the source and impact dimensions are significantly correlated (we will test this proposition later in the paper). We believe that information about both dimensions is useful for several reasons. First, the near-term possibility of a shadow-price shock has raised the stakes for national policymakers. They want to understand the sources and significance of their vulnerability in each dimension. Policy researchers are most interested in exploring high-vulnerability cases, and those involving the poor may be particularly compelling. Our two-dimensional typology may also be useful for assessing the stakes for international climate change negotiations. Resistance to a new global protocol should be greatest from countries with low impact vulnerability and high source vulnerability. Conversely, the most support should come from countries with low source vulnerability and high impact vulnerability. Positioning countries in the two dimensions may provide useful insights about the levels and types of incentives needed to bring all countries to the international bargaining table.

3. Source Vulnerability

3.1 Hydrocarbons

Fossil fuels enjoy a natural economic advantage in economies with ample local supplies, because these fuels are costly to transport. In many cases, they may also be primary sources of export earnings. For both reasons, a global emissions reduction protocol will impose a greater shadow price shock on countries with significant hydrocarbon resources. Countries with large coal deposits have the highest sensitivity, since coal is the most emissions-intensive fossil fuel. Emissions intensities from oil and natural gas are about 75% and 60% of coal's intensity, respectively.[3] To index the relative vulnerability of different countries to a shadow price shock, we divide their total estimated reserves of coal, oil, and natural gas by their total annual energy consumption (both in mtoe – millions of tons of oil equivalent). We believe that this normalization produces a reasonable proxy for relative dependence on fossil fuels (i.e., local coal reserves of 20 mtoe have more significance for an economy with 1 mtoe of annual energy consumption than for an economy with 500 mtoe). We present results for the highest-vulnerability countries in Table 4, including a weighted total that assigns fuels weights equal to their relative greenhouse emissions intensities.[4] Countries are sorted in decreasing order for each fuel.

For coal, the highest-vulnerability region comprises seven ex-COMECON economies (Kazakhstan, Ukraine, Russia, Poland, Czech Republic, Hungary, Bulgaria). Coal deposits are also high relative to energy consumption in countries of Oceania (Australia, New Zealand), North America (US, Canada), Southern Africa (South Africa, Zimbabwe), South Asia (India, Pakistan), and East Asia (China, Indonesia). In contrast, Latin America has only two high-vulnerability economies (Colombia, Venezuela), and in Western Europe, only Germany and the UK have even modest coal reserves relative to domestic energy consumption.

Oil deposits are highly concentrated, with the majority of vulnerable economies in the Middle East and North Africa (13 countries - Kuwait, Iraq, UAE, Saudi Arabia,

---

[3] Source: International Energy Agency data.
[4] Complete estimates for countries are presented in the tables below.

Libya, Qatar, Iran, Yemen, Oman, Sudan, Algeria, Syria, Tunisia), West Africa (6 countries - Congo, Gabon, Angola, Equatorial Guinea, Nigeria, Chad), the former USSR (3 countries -- Kazakhstan, Azerbaijan, Russia), and Andean and Central America (5 countries - Venezuela, Ecuador, Trinidad and Tobago, Peru, Mexico). Norway and Brunei also have significant supplies relative to their energy consumption.

Gas follows a similar pattern: Middle East and North Africa (11 - Qatar, Iran, UAE, Algeria, Yemen, Iraq, Oman, Libya, Kuwait, Saudi Arabia, Egypt), Andean America and the Caribbean (4 - Bolivia, Venezuela, Trinidad and Tobago, Peru), the former USSR (5 - Turkmenistan, Azerbaijan, Russia, Kazakhstan, Uzbekistan), Southeast Asia (4 - Brunei, Malaysia, Myanmar, Indonesia), Western Europe (2 – Norway, Netherlands), and a few countries in other regions (Nigeria, Australia, Bangladesh).

At current prices, exploitable reserves also include natural bitumen (tar sands, heavy crude) and oil shale. As Table 4 shows, known reserves are very large and highly concentrated in a few countries in the Western Hemisphere (Venezuela, Canada, the US, Brazil), the Middle East, and North Africa (Jordan, Morocco, Israel).

Our weighted total hydrocarbon vulnerability measure reflects the concentrated pattern of vulnerability for the individual hydrocarbon sources. Under a global emissions reduction protocol, highly-ranked countries would face relatively high opportunity costs (domestically and via foregone export earnings) in the transition to clean energy use. This would be particularly true for coal, the most emissions-intensive fossil fuel.

3.2 Employment

Employment is another potentially-important dimension of vulnerability to a shadow price shock. In this paper, employment vulnerability also serves as a proxy for the distributional implications of a global emissions protocol. To estimate differential employment vulnerability, we combine information from several sources. We use UN data to compute GDP for 2002 (in constant 1990 $US) in six composite sectors: Mining and Energy, Manufacturing, Construction, Services, Transport and Other. Using data from the International Energy Agency, we aggregate estimated CO_2 emissions from 64 subsectors into the six composite sectors. We divide sectoral emissions by sectoral GDP to obtain greenhouse emissions intensities. Using employment data from the ILO, we compute the shares of the composite sectors in total employment. We then compute the employment-weighted average emissions intensity for each country, using sectoral employment shares as weights. This provides a first-order estimate of employment vulnerability, since countries with relatively high emissions intensities in high-employment sectors are likely to be most affected by a shadow-price shock.

Tables 5 and 6 summarize our results for four groups of countries: low income, ex-COMECON (Eastern Europe, Central Asia), middle income and OECD high income. For ease of comparison, we normalize so that the maximum intensity is equal to 100. The results indicate that employment vulnerability is heavily concentrated in low-income and ex-COMECON countries. The median value of the employment vulnerability index (EVI) drops by 50% from low- to middle-income countries, and by over 50% again from middle- to high-income countries. In the overall distribution, China joins India among countries whose vulnerability puts them in the highest quartile. As Figure 6 shows, the EVI distributions do not even overlap for the low- and high-income groups. Although data scarcity prevents us from calculating EVI's for all countries, our results indicate that a shadow price shock is likely to have the most pronounced impact on employment in the world's poorest and most populous countries.

4. Clean Energy Potential

4.1 Solar, Wind, Hydro, Geothermal

We have used the best available data to develop estimates of potential energy from solar, wind, hydro and geothermal sources in the medium term.[5] While our assumptions about convertibility are optimistic, we believe that they are feasible. In addition, for solar, wind and geothermal we adopt low, intermediate and high scenarios to incorporate uncertainties about these technologies. For solar, we assume collection by photovoltaic (PV) cells on shares of each country's land area ranging from 0.05 to 0.18%.[6] For conversion to electric power, we use alternative efficiency levels (15-20%). For wind,

[5] See Figures 1-3 for illustrations of the global distributions of solar, wind and geothermal energy.
[6] Note that we do not include solar water heating in cold climates or power generation from concentrated solar plants in regions with high solar insolation. Our estimates for total solar energy production may thus be conservative.

we include estimates at the 80m hub height for both onshore and offshore potential. We employ standard engineering parameters for wind-energy generation with current technology. For onshore potential, we adopt Germany's current siting density as our benchmark, since the German program is well-advanced. Turbine siting assumptions range from Germany's current intensity (as a high) to 60% of that potential (low). For offshore wind, we estimate the potential for turbine siting 0-15 km from shore and with bathymetric depths of 0-20m. For hydro, we employ standard estimates of technically-exploitable potential by country. Our geothermal calculations are based on exploitation of subsurface heat potential at an upper intensity limit comparable to Switzerland's current program (15% of potentially exploitable areas), and at a low of 5% of that potential.[7] We also allow for future efficiencies 10-30% higher than current levels. Appendix 1 includes a detailed presentation of our data sources, assumptions and calculations. For the purposes of simulation, we use the intermediate renewable energy potential for solar, wind and geothermal. Figures 4 and 5 show total estimated renewable energy potential (medium estimate) versus current energy consumption for all countries as well as for World Bank regions separately. Complete results are presented in the tables in Appendix 2.

Table 7 presents our basic results for the countries with the greatest renewable resources, relative to their current energy consumption levels. We normalize by energy consumption to index local significance as an option for clean energy conversion (i.e., annual solar energy potential of 20 mtoe has much greater significance for an economy with 1 mtoe of annual energy consumption than for an economy with 500 mtoe). Any ratio greater than 1.0 for a renewable energy source implies that it is potentially sufficient to meet a country's current energy demand. Cross-country patterns differ greatly by energy source but solar is clearly the largest, even though we assume that PV cells cover only one-thousandth of the available land area. Of the top 35 countries overall, 17 are in Sub-Saharan Africa, 7 in Latin America, 2 in the Middle East and North Africa, 3 from the Former Soviet Union, 4 in East Asia, and 3 in the Pacific region. Developing countries that dominate the solar measure are generally in high-insolation regions, with

[7] We do not include potential heating or cooling energy from shallow geothermal systems which could add considerable that could replace conventional fossil-fuel powered HVAC systems.

large areas relative to their economic size (and energy consumption). The most dominant solar group is in Sub-Saharan Africa and, within that region, in the Sahel. Mauritania, Chad, Niger, Mali and CAR are all in the top 10 countries by this measure. Among the high-income economies, only a few enter the top 35 for any renewable category: Australia (overall, solar, wind), Iceland (overall, wind, hydro, geothermal), Norway (wind, hydro), New Zealand (geothermal) and Canada (wind).

Mongolia, some of the Sahelian states and Namibia rank highest in total and solar categories, and Mongolia and Bolivia rank highest in wind and geothermal. Three African states (Congo, Gabon, Congo Democratic Republic) have top-5 rankings for hydro, along with Tajikistan and Papua New Guinea. In addition to Mongolia and Bolivia, the top-5 countries for geothermal include Namibia, Kyrgyzstan and Tajikistan. Table 8 summarizes representation across World Bank regions for countries in the top 35 of each renewable category. In all categories, developing and middle-income clients of the World Bank account for at least 30 of the 35 top-ranking countries. In each case, Sub-Saharan Africa dominates the group.

4.2 Biofuels

Biofuels include biogas from wastes (principally animal manure), biodiesel from oil-producing plants, and ethanol from plant biomass. In this paper, we attempt to estimate potential energy from biofuels under realistic assumptions about availability and conversion efficiency. Appendix 1 includes a detailed presentation of our data sources, assumptions and calculations. Complete results are presented in Appendix 2.

For estimation of biogas potential from manure, we use parameters from existing conversion facilities and develop estimates of collectible manure from FAO livestock data and standard collection efficiency studies. For biodiesel and ethanol, potential yields differ greatly across field crops. Since we are interested in feasible output, we estimate the highest potential yield from crops suitable for cultivation under different agro-climatic conditions. For field crops, we estimate potential yield from 10% of existing suitable land that is not currently forested. The highest ethanol yields per hectare come from sugar-producing plants (sugar cane, sorghum and sugar beets, respectively in three broad latitude belts: tropical, sub-tropical and temperate). We obtain data on suitable lands from the FAO Terrastat database, and use standard yield estimates to derive potential energy production.

In addition, we estimate the potential ethanol yield from native tallgrasses in temperate savanna areas that are currently not used for agriculture. Recent experiments have indicated that potential yields from tallgrasses are very high. The best-known example is switchgrass, a tallgrass native to the North American northern plains, but kindred species grow in similar areas worldwide. Using current estimates of ethanol yield per hectare, we estimate tallgrass potential from a digital map of world ecoregions, developed by WWF International, which explicitly identifies tallgrass savanna areas (specifically, "Temperate Grasslands, Savannas and Shrublands"). Drawing on recent digital mapping work at IFPRI (the International Food Policy Research Institute), we mask out agricultural areas in the tallgrass savanna zones as well as urbanized areas and estimate potential production for a share of the remaining suitable areas in each country.

Finally, we estimate potential biodiesel production from *jatropha curcas*, a hedge plant of Latin American origin that thrives on marginal lands in many arid and semiarid tropical regions of the world. Biodiesel can be extracted directly from jatropha seeds with high yields per hectare, and cultivation does not have to compete with food crops for land because jatropha thrives on marginal lands under widely-varying conditions. To estimate potential biodiesel production from jatropha, we draw on work by WWF and IFPRI to identify appropriate non-agricultural and non-urban areas in two world vegetation regions: Tropical-Subtropical Grasslands, Savannas and Shrublands; and Non-Montane Xeric Shrublands. We use recent studies of jatropha's biodiesel yield per hectare to develop our potential energy estimates.

Tables 9a and 9b summarize our results for the highest-ranking countries, after normalizing each country's resources for annual domestic energy consumption. While biogas from manure plays a relatively minor role, sugar crops, tallgrass and jatropha all make large contributions. Sub-Saharan Africa dominates the top-35 rankings, with 25 countries overall, 26 for sugar crops, 29 for jatropha and 17 for biogas. Latin America / Caribbean ranks second in all categories. African strength in sugar crops is distributed across climate zones, while jatropha potential is particularly concentrated in the Sahel (Mauritania, Chad, CAR, Mali, Niger) and semi-arid regions of southern Africa

(Namibia, Botswana, Angola). Tallgrass potential, on the other hand, is heavily concentrated in 14 countries in the savanna grasslands region of Europe and Central Asia.

Table 10 summarizes our estimates for clean energy resources. With the exception of a few small states (Equatorial Guinea, Rwanda, Cape Verde, Comoros), all countries in Sub-Saharan Africa have a clean energy potential that at least matches their current domestic energy consumption. Most have potentials that are many times their current consumption. The same pattern holds in Latin America and the Caribbean, South Asia, the Middle East and North Africa and the developing countries of Europe and Central Asia. In the East Asia / Pacific region, the ratio of clean energy potential to current energy consumption is 60% or higher for all countries except Samoa, Tonga and Korea. Remarkably, we find that even China and India have estimated clean energy potentials that exceed or nearly match current domestic energy consumption (120% for China, 90% for India). Worldwide, the countries whose clean energy potential is at least 50 times current annual energy consumption include Mongolia (515), Namibia (101) and five Sahelian states in Africa: Central African Republic (91), Mauritania (86), Chad (77), Mali (58) and Niger (50). We conclude that in the medium term, clean energy resources can provide most developing countries with abundant options for damping a shadow price shock from restrictions on global emissions.

5. Sequestration Potential

Countries have two options for sequestering carbon that are likely to be recognized by a global protocol. The first is reduction of emissions from deforestation and other land-clearing. Currently, the World Resources Institute estimates that these activities account for about 19% of total greenhouse emissions. We index the scope of country potential in this dimension by dividing emissions from deforestation and land clearing by total emissions. Table 11 presents the results by region, for countries whose emissions from clearing and deforestation exceed 1% of total emissions. Clearly, reduction on this margin would be the primary task for many developing countries in all regions. Emissions from this source are over 50% of all greenhouse emissions for 37 developing countries: 20 in Sub-Saharan Africa, 10 in Latin America, 5 in East Asia/Pacific, and 2 in South Asia.

The second option is underground sequestration. Drawing on the estimates of Hendriks, *et al*. (2004; see Appendix 1) for 18 world regions, we develop country estimates of CO_2 capture potential in four classes: oil fields, natural gas fields, coal fields, and saline aquifers (the latter mostly offshore). Then we normalize by current energy consumption. Appendix 1 provides a detailed explanation of our methodology. Table 12 summarizes the results, which indicate that this is an important option for a large number of countries. Among 31 developing countries with 50 or more years of sequestration potential, Sub-Saharan Africa has 12 (including Nigeria and South Africa), East Asia 2 (China and Vietnam), Eastern Europe 3 (Russia, Albania, Croatia), Latin America 4 (Venezuela, Suriname, Chile, Bolivia), the Middle East and North Africa 9 (including Iran and Egypt), and South Asia 1 (Bangladesh).

6. Impact Vulnerability

6.1 Sea Level Rise

The anticipated impact of sea-level rise (SLR) has three elements: Natural expansion as the ocean warms; higher ocean levels from icecap melting; and higher storm surges. Recent evidence suggests that the polar caps are melting more quickly than anticipated, and forecasts of a 1-meter rise in this century no longer appear implausible. If melting accelerates further, a 3-meter forecast will become plausible.[8] A recent study by DECRG (Dasgupta *et al*., 2007) has used high-resolution digital mapping to estimate country impacts of SLR in the range of 1-5 meters. Using GIS overlays, the study computes the percentages of total population, agriculture and general economic activity on land that will be covered by a 1 and 3-meter SLR. For this paper, we index the potential impact using the average 3-meter percent coverage for GDP. The study focuses on developing countries that are not small islands, so we do not have comparative SLR impact measures for most islands. However, it is clear that many small islands will be seriously impacted by SLR. We have only one comparable island economy, the Bahamas, whose estimated coverage area at 3-meter SLR accounts for 14.5% of current

[8] Total melting of the Greenland icecap would raise sea level by approximately 7 meters. Total melting of the West Antarctic ice sheet would also raise sea level by about 7 meters.

GDP. This is one of the highest estimated impacts in the world. To account for this factor in our comparative assessment, we arbitrarily assign other small islands a 15% estimate for GDP coverage. Table 13 provides a summary of SLR estimates that we use for this study. With the exception of island states, coverage is reasonably complete for World Bank client countries. Non-island states with measured impacts[9] include 27 of 42 countries in Sub-Saharan Africa, 10 of 11 in East Asia / Pacific, 7 of 28 in Europe / Central Asia, 21 of 23 in Latin America / Caribbean, 9 of 14 in Middle East / North Africa, and 4 of 7 in South Asia.

Table 14 presents impact estimates for specific countries. Besides island states, where significant impacts are likely in most cases, the distribution of potential impacts for a 3-meter SLR is strongly skewed in all regions. East Asia / Pacific registers most strongly, with 8 of 10 measured non-island countries experiencing an impact of 1% or more. These are large, populous countries, so the implications of SLR for this region (which also includes many islands) are clearly serious. Vietnam is particularly striking (24.2%, reflecting heavy impacts in the Mekong and Red River Deltas), and China's estimated impact (5.6%) is huge in absolute value. Sub-Saharan Africa has a lower incidence, with impacts over 1% in 10 of 27 measured non-island countries. However, four states experience heavy impacts: Mauritania (17.5%), Benin (14.8%), Senegal (8.1%) and Gambia (7.6%). Among European and Central Asian countries 4 have impacts above 1% of GDP: Georgia (2%), Ukraine (1.5%), Estonia (1.5%) and Turkey (1.1%). In Latin America, 12 countries have impacts in a comparable range, while Middle East./North Africa has four: Egypt (12.1%), Tunisia (4.9%), Libya (2.4%) and Oman (1.4%).

In summary, our assessment for a 3-meter SLR suggests that GDP impact percentages greater than 5% will be mostly limited to islands and small coastal states. However, there are important exceptions to this pattern in Sub-Saharan Africa, North Africa and East Asia. In South Asia and Latin America as well, relatively "modest" impacts for states such as India, Bangladesh, Brazil and Mexico translate to very large absolute numbers.

[9] These include landlocked countries, where direct SLR impact is zero.

6.2 Weather Damage

Regional forecasts of climate change remain uncertain, although there is general agreement that variability will increase, and existing weather conditions are likely to be exacerbated. At present, it seems most reasonable to assume that future weather conditions in each country will reflect historical conditions, but with more extreme events. To index expected damage, we draw on the Emergency Disasters Database (EM-DAT) maintained by the Center for Research on the Epidemiology of Disasters at the Université Catholique de Louvain in Brussels. We develop our country indices from all recorded disasters during the period 1960-2002 that are attributed to weather-related events: droughts, extreme temperatures, floods, wild fires and wind storms. Since estimates of economic damage are extremely spotty, we develop a weighted damage measure from population impacts in three categories: killed (weight 1000), homeless (10) and affected (1). Then we divide by population for 1980 (the midpoint of the period) to develop the final index: population impact relative to population size. Table 15 summarizes the results by region, while Table 16 presents country indices.

Both tables illustrate two striking facets of these data. First, there are very large regional differences in human vulnerability to weather events. For South Asia and East Asia / Pacific, the median indices for population impact relative to size are over twice the indices for Sub-Saharan Africa and Latin America / Caribbean. These are, in turn, at least four times the index for Middle East / North Africa and 14 times the index for Eastern Europe and Central Asia. Second, intraregional distributions are quite skewed, and at least one country in several regions has extreme vulnerability relative to the others. Clear outlier countries include Ethiopia, Mozambique, Sudan, Honduras, Iran and Bangladesh.

Among countries with large populations, those with vulnerability indices above 200 are Ethiopia (1,809), Philippines (392), Vietnam (235), China (223), Bangladesh (1,940) and India (566). Island states with indices above 200 also figure prominently in the Pacific (Tonga, Somoa, Solomons, Vanuatu, Fiji) and the Caribbean (Antigua and Barbuda, Haiti, St. Lucia).

7. Country Stakes in Climate Change Negotiations

For a comparative assessment of country stakes in climate change negotiations, we focus on summary measures of source and impact vulnerability. We simplify by computing aggregative indices from variables whose measures are compatible. The first index is the weighted sum of nonrenewable energy sources (coal, oil, gas, natural bitumen, oil shale), measured in year-equivalents of current domestic energy consumption and weighted by relative CO_2 intensity (1.0, 0.75, 0.60, 0.75, 0.75, respectively). The second index aggregates renewable energy sources (solar, wind, hydro, geothermal, biogas, sugar ethanol, tallgrass ethanol, jatropha ethanol), again in year-equivalents of domestic energy consumption. Our two sequestration variables (potential for reduced deforestation and carbon storage) are not measured in compatible units, so we leave them separate. For the same reason, we leave the two impact variables (sea level rise, weather damage) separate.

7.1 Overall Correlations

Our indices all have highly skewed distributions, so we compute rank correlations to obtain robust estimates of their relationships. Table 17 presents the results, with starred coefficients denoting significance at the 95% level. We are particular interested in assessing the interaction of two broad dimensions: source vulnerability (related to factors affecting the response to emissions limits – nonrenewables, renewables, employment risk and sequestration options) and impact vulnerability (sea level rise and weather damage). Part of our interest lies in determining whether correlations suggest reinforcing or offsetting effects within the two vulnerability groups. We are also interested in the overall direction of the relationship between the two dimensions, because this has implications for successful negotiation of a global protocol. In general, countries with high impact vulnerability and low source vulnerability should be the strongest supporters of a protocol, while the converse should be true for countries with low impact vulnerability and high source vulnerability. Country postures in the other two cases (both vulnerabilities high or low) would depend on the relative strength of the two effects.

Within the source vulnerability group, Table 17 indicates that four correlations are significant and relatively large, and that all four moderate overall vulnerability via offsetting effects. Countries with plentiful non-renewable energy resources (relative to energy demand) also tend to have significantly less sequestration storage potential. Countries with more sources of renewable energy tend to have slightly less non-renewable energy. Countries with relatively high employment vulnerability also tend to have less renewable energy resource options (again, relative to energy demand) and less potential for sequestration through reduced deforestation. As a statistical corollary, countries with plentiful renewable energy sources also tend to have high potential for sequestration through reduced deforestation; and those with higher sequestration (storage) opportunities tend to have less potential for sequestration through reduced deforestation.

Within the impact vulnerability group, the two dimensions have a small but significant negative correlation: Countries with large potential impacts from sea level rise tend to have smaller potential damage from weather events.

Across the two dimensions, overall results are mixed. Countries vulnerable to sea level rise tend to have weaker options for renewable energy and sequestration via reduced deforestation, higher employment vulnerability and greater options for sequestration via storage. Countries vulnerable to weather damage also tend to have lower employment vulnerability. However, they also have greater renewable and non-renewable energy options, less potential for storage sequestration and greater potential for sequestration via reduced deforestation.

To summarize, our correlation results suggest that countries with high source vulnerability in some dimensions tend to have lower vulnerability in others. The same is true for impact vulnerability. Between source and impact vulnerability, the evidence is mixed. While these general results are of some interest, none of the observed correlations is very high. By implication, country cases should be our principal focus because they tend to be unique.

7.2 Country Cases

For a composite view, we combine all of our vulnerability measures into a general index that reflects countries' ability and willingness to participate in an international protocol. We construct an index with high values for low source vulnerability and high impact vulnerability, and low values for the converse case. Again, we ensure robust estimates by using ranks rather than numerical values. We also normalize ranks to the range 1-100 to prevent distortion from differences in data structure.[10]

Our analysis considers seven dimensions that affect country orientation. Five dimensions promote a positive orientation toward a protocol: Three reflect source vulnerability (renewable energy resources and both dimensions of sequestration (deforestation reduction and storage)), and two relate to impact vulnerability (sea level rise, weather damage). Ceteris paribus, the higher a country's measure in any of these dimensions, the greater the relative attraction of a global protocol. Two dimensions, both source vulnerability elements, reflect negative factors: nonrenewable energy resources and employment vulnerability. Ceteris paribus, the greater a country's measure in either dimension, the lower the relative attraction of a global protocol.

To develop an overall orientation index, we compute standard ranks (rank 1 for the largest value) for the five positive dimensions and inverse ranks (rank 1 for the smallest value) for the two negative dimensions. We compute one sequestration measure by averaging ranks for deforestation and storage potentials. We normalize all six remaining rank measures to the range 0-100 and select the set of non-island states that have complete measures for all variables.[11] This yields a computation set of 120 countries. We compute orientation indices as weighted averages of dimensional ranks, with total weights constrained to one (Table 18). We test for robustness by computing indices with widely-varying weights to reflect relative emphasis on energy resources (renewable and nonrenewable), impact vulnerability (sea level rise; weather damage); neutrality (equal

[10] Almost all countries have a non-zero measure for weather damage, but measures in other dimensions have several missing values or zeros. Arbitrary assignment of rank numbers by standard algorithms can lead to misleading comparisons in such cases. Remapping dimensional ranks to the range 1-100 neutralizes this potential distortion. The appropriate transformation is: $Y = 1+99*[(X\text{-}Min(X))/(Max(x)\text{-}Min(x)]$.

[11] Although they are numerous, small island states represent a special case because of their particular vulnerability to sea level rise.

weights); positive source factors (renewable energy; sequestration potential) and negative source factors (nonrenewable energy, employment vulnerability).

Table 19 reports the results for countries, by World Bank region. For each weighting scheme, we compute index values for all 120 countries and divided the results into three equal groups with high (1), medium (2) and low (3) values. Then we tabulate the results for each country. We assign countries to the High orientation category if at least three of five index values are 1's and the rest are 2's. We assign them to the Low orientation category if at least two of five values are 3's. Intermediate cases are assigned to the Middle category.

Tables 20, 21 and 22 provide useful information about general relationships. Table 20 indicates that correlations among the six dimensional indices are all relatively low, except between renewable energy sources and employment vulnerability and weather damage. Nevertheless, Table 21 shows that alternatively-weighted combinations of these indices are highly correlated, with one exception: high weights for positive source vulnerability factors (index D: renewable energy; sequestration potential) vs. high weights for negative source vulnerability factors (index E: nonrenewable energy, employment vulnerability). Table 22 shows that many countries retain their orientations as the index weights change. Overall, 35 of 120 countries rate 'High' because they display positive orientations across all five weighting schemes. Conversely, 48 countries are consistently 'Low'. The results suggest that the Latin America / Caribbean region has the strongest regional orientation toward a protocol, with 16 countries scoring 'High', 5 'Middle' and 1 'Low'. However, sub-regions are distinctly different. Non-Andean South America and Central America are almost completely in the 'High' Category, while the Andean countries (except Peru and Ecuador, which are 'High') are 'Middle' and the Caribbean is mixed.

In contrast, Eastern Europe / Central Asia (except Georgia) and South Asia are predominantly 'Low' regions: 18 of 21 ECA countries and 2 of 4 SAR countries, including India, are in the 'Low' category. The Middle East / North Africa region is also unbalanced in this direction, with 2 'High', 3 'Middle' and 4 'Low'.

Sub-Saharan Africa and East Asia / Pacific are more evenly balanced. In Sub-Saharan Africa, 12 states are 'High', 14 'Middle' and 8 'Low'. Within the region, however, sub-regions differ markedly. Among Coastal West African states, 8 are 'High', 1 'Middle' and 2 Low. In contrast, all Central African states are 'Middle' (5) or 'Low' (3). The Sahelian, Eastern and Southern Africa sub-regions exhibit more diversity.

Unfortunately, our evidence also suggests that, among the World Bank's partner countries, total emissions are much greater from the 48 'Low' states than from the 35 'High' states. Overall, 'High' states account for 21.0 % of emissions, while 'Low' states account for 50.1% (Table 23). China and India, both 'Low' states, account for nearly 80% of that group's emissions. However, even among states other than the four greatest emitters (China, Indonesia, Brazil, India), 'Low' states account for the greatest share of emissions. This unfortunate result provides a suggestive indicator of potential difficulty in attempting to extend an emissions-reduction protocol to low- and middle-income countries in the next round.

To summarize, our results suggest that the geographic distribution of protocol orientation is far from random. Among 35 states with 'High' scores, almost two-thirds are in three sub-regions: non-Andean South America (8), Central America (6), and Coastal West Africa (8). States with 'Low' scores also display some concentration, particularly in Eastern Europe and Central Asia. Unfortunately, carbon emissions are also heavily concentrated in World Bank states with 'Low' scores: China (4.9 Gt), India (1.8 Gt) and 46 others (4.2 Gt) (Table 23).

7.3 Two Dimensions of Country Vulnerability

It is also useful to position countries two-dimensionally, according to their relative source and impact vulnerability. We focus on non-island states, and for this exercise we include states with some incomplete data. Using normalized ranks (1 – 100), we compute source and impact vulnerability indices as means of the available dimensional indices for each country (four for source vulnerability (nonrenewable energy, renewable energy, sequestration, employment); two for impact vulnerability (sea level rise, weather damage)). Then we divide the source and impact vulnerability index values into equal 'Low', 'Medium' and 'High' groups.

Table 24 and Figure 7 present our results for non-island states. Ceteris paribus, 'High' source vulnerability should discourage participation in a global protocol, while

‘High’ impact vulnerability should encourage it. The most positively-oriented states should therefore have ‘Low’ source vulnerability and ‘High’ impact vulnerability. In Table 24, 26 states are in this category. All are low- or middle-income countries, and they are heavily concentrated in three regions: Latin America, Sub-Saharan Africa and Southeast Asia.

Table 25 indicates that these 26 states account for about 11% of tabulated emissions. Table 24 identifies 32 states with the greatest negative orientation (‘High’ source vulnerability, ‘Low’ impact vulnerability). These are middle- and high-income countries, concentrated in three regions: Eastern Europe, Central Asia and the Middle East. However, a number of these negatively-oriented countries are major emitters. Table 25 shows that together, they account for about 11% of total emissions (dominated by CO_2 emissions from the Russian Federation, see Table 3).

Table 25 shows that two groups with the greatest volume of emissions are subject to conflicting pulls in the two dimensions of vulnerability. The countries with ‘High’ source vulnerability and ‘High’ impact vulnerability account for about 19% of all emissions. Of particular interest in the ‘High’/’High’ group are China and India, which together account for 68% of the greenhouse emissions from countries in the lower half of the international income distribution (Table 3). The ‘High’/’Medium’ group, accounting for 27% of emissions in Table 25, is dominated by the United States and the Ukraine.

8. Summary and Conclusions

In this paper, we report results from a broad survey of country stakes in the control of greenhouse emissions. We identify source and impact vulnerability as two major dimensions of the problem. Sub-dimensions of source vulnerability include renewable energy sources, potential for carbon sequestration, nonrenewable energy sources, and employment vulnerability. The sub-dimensions of impact vulnerability are sea-level rise and weather-related damage. In our typology, four sub-dimensions have positive effects on countries’ orientation toward a global emissions protocol: renewable energy sources, sequestration potential, sea level rise, and weather damage. Conversely, two dimensions have negative effects: Nonrenewable (fossil fuel) energy sources and employment vulnerability.

To index these broad dimensions, we assemble the best available information on components and standardize their measurement for aggregation. Within the nonrenewable energy category, we develop estimates of total resource deposits for coal, oil, natural gas, natural bitumen and oil shale. To make aggregation possible, we translate the estimates to millions of tons of oil equivalent (mtoe). Similarly, we develop mtoe-equivalent estimates for many renewable energy resources: solar, wind, hydro, geothermal, and four biofuel sources: biogas from manure; ethanol from sugar crops (which have the highest ethanol yield among food crops), savanna tallgrass (in land not cleared for agriculture), and biodiesel from jatropha (in land not cleared for agriculture).

Our other dimensions are measured in diverse units. For employment vulnerability we develop a weighted average of sectoral emissions intensities, where the weights are shares of total employment. For sequestration, we separately index the potential contribution of reduced deforestation [(annual CO_2 emissions from deforestation)/(total annual CO_2 emissions)] and underground storage. To index storage potential, we divide total annual CO_2 emissions into total CO_2 storage capacity in existing coal, oil and gas fields, plus saline aquifers that extend into territorial waters.

We measure two dimensions of impact vulnerability: sea level rise and weather damage. Our index for sea level rise is the estimated percentage of GDP accounted for by areas that will be covered by a 3-meter rise. For weather damage, we develop an index of population affected by climate-related events since 1960 and divide it by total population in 1980.

After indexing the basic dimensions of the problem, we assess the structure of the data. We find generally low correlations among dimensions, except for carbon sequestration and nonrenewable energy resources. The low correlations imply that each dimension adds significant independent information about country circumstances, making it difficult to generalize about "typical" conditions confronting countries subject to an international emissions-reduction protocol. We extend the analysis by combining information from the six dimensions into weighted indices. We test for the existence and robustness of country clusters by computing five indices with very different weights. We find large numbers of countries that have persistently high or low index values, implying a high likelihood that many countries do in fact have very different stakes in a global protocol. Countries with positively-oriented states are highly clustered in Latin America and West Africa, while Eastern Europe and Central Asia have a large number of countries with unfavorable stakes. Other regions have mixed conditions, but individual countries within those regions often have persistently favorable or unfavorable stakes. Unfortunately, countries with unfavorable stakes (by our composite measure) include two of the largest emitters – India and China. Many other significant emitters have unfavorable stakes as well. Together, the states with unfavorable stakes account for almost half of all CO_2 emissions from World Bank partner countries. In contrast, countries with favorable stakes account for about 19% of total emissions.

We perform an alternative assessment of protocol orientation by positioning countries according to their source and impact vulnerability. Among countries in the two most extreme categories, we find clear regional differences. Those with the most positive orientation to a global protocol ('Low' source vulnerability, 'High' impact vulnerability) are all low- or middle-income states, and are heavily concentrated in Latin America, Sub-Saharan Africa and Southeast Asia. Conversely, countries with the most negative orientation ('High' source vulnerability, 'Low' impact vulnerability) are almost all middle- or high-income states in Eastern Europe, Central Asia and the Middle East.

We draw four broad conclusions from this exercise. First, with six dimensions of vulnerability affecting country stakes, even neighboring states in the same region can have very different orientations toward a global protocol. Policy analysis and dialogue should therefore be tailored to specific conditions in each country. Second, despite significant country-level variation in each region, our analysis does indicate sufficient regional clustering to warrant some attention to regional strategies. Third, even with good information and programs tailored to country conditions, our results suggest that many countries will resist a global protocol unless they are compensated for disadvantages associated with source vulnerability. Many countries have persistently unfavorable stakes in emissions reduction, no matter how we index their relative vulnerability. As a group, furthermore, they account for almost half of all CO_2 emissions from the World Bank's partner countries. Ultimately, we believe that successful negotiation of a global protocol will require the design of compensation and cross-subsidy mechanisms that reflect the dimensions of vulnerability that we identify in this paper.

Having said this, we should conclude on a note of optimism. Although individual countries have very different stakes in climate change negotiations, the global stakes are much clearer and more positive. Our assessment of renewable energy alternatives suggests that the world community can draw on enormous clean energy sources to ease the transition to global sustainability. The ultimate keys to negotiating a global protocol are neither technical nor economic, but institutional and political. Once the international community becomes convinced that we face a climate crisis, it should be possible to organize the politics of compensation and cross-subsidy that will have to accompany a truly global protocol for greenhouse emissions reduction.

Table 1: Distribution of CO2 Intensities by Income Group
(164 Countries – Intensities in tons/$10,000)

Group #	Income Group	Min	Q1	Median	Q3	Max
1	$ 460 - $ 2,000	0.188	0.895	2.040	3.173	31.750
2	$ 2,000 - $ 4,999	0.682	2.295	4.364	8.144	20.314
3	$ 5,000 - $12,499	1.581	2.781	4.890	6.932	22.849
4	$12,500 - $56,300	0.297	2.847	3.629	4.911	18.339
	Total	0.188	1.987	3.470	5.761	31.750

Source: World Bank: World Development Indicators, 2005

Table 2: CO2 Intensities and Income Per Capita ($US PPP 2000):
Selected Low- and High-Income Countries

Low-Income Countries	CO2 Intensity (2000)	Income Per Capita	High-Income Countries	CO2 Intensity (2000)	Income Per Capita
Kenya	3.10	1,002	Norway	3.16	35,132
Nigeria	3.24	878	Netherlands	3.20	27,229
Pakistan	3.94	1,925	United Kingdom	3.91	24,675
Cote d'Ivoire	4.18	1,585	Finland	4.11	25,141
Yemen, Rep.	5.84	826	United States	5.82	34,114

Source: World Bank: World Development Indicators, 2005

Table 3: Largest CO2 Emitters by Income Group (CO2 in '000 tons/year)

Low and Low-Middle Income	CO2	Percent	Cum. Percent		High-Middle and High Income	CO2	Percent	Cum. Percent
China	2,790,451	49.2	49.2		United States	5,601,509	32.9	32.9
India	1,070,859	18.9	68.1		Russian Federation	1,435,057	8.4	41.3
Ukraine	342,771	6.0	74.1		Japan	1,184,502	7.0	48.3
Indonesia	269,568	4.8	78.8		Germany	785,510	4.6	52.9
Egypt, Arab Rep.	142,226	2.5	81.4		United Kingdom	567,843	3.3	56.2
Kazakhstan	121,275	2.1	83.5		Canada	435,858	2.6	58.8
Uzbekistan	118,626	2.1	85.6		Italy	428,171	2.5	61.3
Pakistan	104,805	1.8	87.4		Korea, Rep.	427,014	2.5	63.8
Philippines	77,530	1.4	88.8		Mexico	423,972	2.5	66.3
Belarus	59,152	1.0	89.8		Saudi Arabia	374,344	2.2	68.5
					France	362,432	2.1	70.6
Subtotal	5,097,262	89.8			Australia	344,760	2.0	72.7
					South Africa	327,280	1.9	74.6
Overall Total	5,673,953	100.0			Iran, Islamic Rep.	310,301	1.8	76.4
					Brazil	307,520	1.8	78.2

					Poland	301,346	1.8	80.0
					Spain	282,934	1.7	81.6
					Turkey	221,555	1.3	82.9
					Thailand	198,647	1.2	84.1
					Korea, Dem. Rep.	188,857	1.1	85.2
					Venezuela, RB	157,750	0.9	86.1
					Malaysia	144,413	0.8	87.0
					Netherlands	138,866	0.8	87.8
					Argentina	138,188	0.8	88.6
					Czech Republic	118,772	0.7	89.3
					Belgium	102,244	0.6	89.9
					Greece	89,603	0.5	90.4
					Algeria	89,416	0.5	91.0
					Romania	86,280	0.5	91.5
					Iraq	76,336	0.4	91.9
					Israel	63,098	0.4	92.3
					Austria	60,848	0.4	92.6
					Portugal	59,833	0.4	93.0
					Chile	59,500	0.3	93.3
					Singapore	59,045	0.3	93.7
					Subtotal	15,953,603	93.7	
					Overall Total	15,868,476	100.0	

Source: World Bank, World Development Indicators, 2005

Table 4: Fossil Fuel Deposits, in Years of Total Domestic Energy Consumption

Country	Total	Country	Coal	Country	Oil	Country	Gas	Country	Bitumen	Country	Shale
Jordan	3,364	Australia	382	Kuwait	630	Qatar	1,911	Venezuela	700	Jordan	4,478
Qatar	1,270	Kazakhstan	343	Iraq	535	Iran, Islamic Rep	180	Canada	181	Morocco	549
Venezuela	734	South Africa	242	UAE	359	Turkmenistan	157	Jordan	7	Australia	328
Australia	643	Colombia	157	Saudi Arabia	287	Bolivia	155	USA	2	USA	58
Kuwait	511	Ukraine	136	Congo	273	UAE	150	Romania	0	Brazil	51
Kazakhstan	465	Russia	117	Libya	272	Brunei	142			Ukraine	50
Iraq	461	India	80	Venezuela	213	Papua New Guinea	136			Israel	29
Morocco	412	Poland	68	Gabon	190	Algeria	134			Thailand	10
UAE	360	United States	60	Qatar	164	Azerbaijan	106			Turkey	4
Libya	247	Czech Rep	50	Iran, Islamic Rep	146	Yemen	105			Albania	3
Saudi Arabia	245	China	47	Angola	138	Iraq	99				
South Africa	242	Zimbabwe	33	Kazakhstan	117	Oman	83				
Iran, Islamic Rep	217	Hungary	27	Equatorial Guinea	97	Norway	82				
Congo	205	Pakistan	21	Yemen	91	Venezuela	72				
Ukraine	178	Brazil	20	Azerbaijan	82	Libya	72				
Russia	171	Indonesia	20	Ecuador	79	Russia	70				
Colombia	164	New Zealand	20	Brunei	71	Kuwait	64				
Canada	160	Bulgaria	19	Oman	70	Kazakhstan	58				
Gabon	142	Greece	18	Chad	55	Trinidad & Tobago	53				
Brunei	138	Canada	14	Sudan	55	Saudi Arabia	49				
Yemen	131	Turkey	12	Algeria	52	Nigeria	49				
Azerbaijan	125	Venezuela	6	Nigeria	51	Malaysia	43				
Algeria	119	Germany	5	Norway	49	Myanmar	36				
United States	107	Thailand	5	Syrian Arab Rep	22	Egypt	33				
Angola	104	Mexico	4	Russia	17	Uzbekistan	32				
Oman	102	Vietnam	2	Trinidad & Tobago	12	Peru	24				
Turkmenistan	98	Spain	1	Peru	12	Australia	20				
Bolivia	93	United Kingdom	1	Mexico	11	Bangladesh	19				
Norway	86	Japan	0	Tunisia	11	Netherlands	16				
India	83	Korea, Rep	0	Malaysia	10	Indonesia	*16*				

Sources: BP, WEC (see Appendix 1)

Table 5: Employment Vulnerability Indices (EVI) by Group

Low-Income	EVI	Eastern Europe / Central Asia	EVI	Middle Income	EVI	OECD High Income	EVI
Tanzania	100	Poland	39	China	29	Korea, Rep	10
Zimbabwe	43	Ukraine	39	Iran, Islamic Rep	26	Greece	10
India	43	Bulgaria	36	Ecuador	23	Portugal	9
Togo	27	Serbia and Montenegro	36	Trinidad Tobago	18	Belgium	8
Congo	24	Lithuania	34	Oman	17	Canada	7
Nicaragua	23	Moldova, Rep	33	Egypt	17	Netherlands	7
Yemen	20	Slovakia	31	Guatemala	16	Australia	5
Ethiopia	12	Czech Rep	25	Colombia	15	Finland	5
		Russian Federation	20	Philippines	11	Norway	5
		Georgia	20	Peru	11	New Zealand	5
		Latvia	16	Brazil	9	Germany	5
		Hungary	14	Mexico	9	France	4
		Kazakhstan	14	Dominican Rep	9	Spain	4
		Turkey	9	Panama	8	Italy	4
		Slovenia	6	Argentina	5	UK	4
		Albania	5	Costa Rica	4	Ireland	4
		Croatia	4			Japan	4
						Sweden	3
						Denmark	3
						Switzerland	3
						Luxembourg	2
						Iceland	2

Table 6: Employment Vulnerability Index Statistics by Group

Group	Min	Q1	Median	Q3	Max
Low Income	12	22	26	43	100
Eastern Europe / Central Asia	4	14	20	34	39
Middle Income	4	9	13	18	29
OECD High Income	2	4	5	7	10
Total	2	5	10	23	100

Table 7: Annual Renewable Energy Resources, in Years of Total Domestic Energy Consumption (Intermediate source cases)

Country	Total	Country	Solar	Country	Wind	country	Hydro	country	Geothermal
Mongolia	66.19	Mongolia	52.48	Mongolia	9.27	Tajikistan	6.50	Mongolia	2.37
Mauritania	30.11	Namibia	27.21	Bolivia	7.86	Congo	4.33	Bolivia	0.65
Namibia	28.14	Mauritania	26.17	Iceland	6.98	Gabon	4.03	Kyrgyzstan	0.33
Chad	23.00	Chad	22.63	Mauritania	3.94	Congo, Dem Rep	4.02	Namibia	0.32
Bolivia	20.15	Niger	19.05	Chile	2.82	Papua New Guinea	3.47	Tajikistan	0.25
Niger	19.08	Mali	16.74	Paraguay	2.56	Kyrgyzstan	3.12	Morocco	0.25
Mali	16.88	Central African Rep	13.78	Tajikistan	2.41	Lao PDR	2.66	Peru	0.16
Congo	16.80	Congo	12.47	Argentina	2.30	Guyana	2.38	Turkmenistan	0.14
Central African Rep	13.92	Bolivia	9.31	Kyrgyzstan	1.86	Bolivia	2.34	Iceland	0.10
Guyana	11.10	Guyana	8.71	New Zealand	1.78	Madagascar	2.17	Russia	0.09
Tajikistan	10.42	Sudan	6.32	Georgia	1.42	Georgia	2.13	Botswana	0.08
Congo, Dem Rep	9.39	Papua New Guinea	5.84	Sudan	0.90	Mongolia	2.07	Congo, Dem Rep	0.08
Papua New Guinea	9.33	Yemen	5.58	Ireland	0.86	Paraguay	1.74	New Zealand	0.08
Gabon	9.05	Botswana	5.47	Azerbaijan	0.71	Peru	1.73	Indonesia	0.06
Iceland	9.01	Solomon Islands	5.46	Cape Verde	0.69	Iceland	1.50	Kenya	0.05
Paraguay	7.41	Angola	5.34	Australia	0.68	Nepal	1.48	Armenia	0.05
Kyrgyzstan	7.35	Congo, Dem Rep	5.30	Madagascar	0.63	Cameroon	1.40	Latvia	0.04
Sudan	7.34	Gabon	5.02	Denmark	0.57	Cambodia	1.29	Moldova, Rep	0.04
Lao PDR	6.65	Zambia	4.13	Yemen	0.53	Ethiopia	1.04	Zambia	0.04
Madagascar	6.27	Peru	4.09	Canada	0.52	Costa Rica	0.97	Thailand	0.04
Angola	6.15	Lao PDR	3.99	Antigua & Barbuda	0.50	Myanmar	0.83	Uzbekistan	0.04
Yemen	6.11	Libya	3.82	Armenia	0.49	Angola	0.82	Azerbaijan	0.04
Peru	5.97	Mozambique	3.80	Nicaragua	0.39	Cyprus	0.78	Estonia	0.03
Solomon Islands	5.91	Madagascar	3.48	Chad	0.36	Sierra Leone	0.68	Tanzania	0.03
Botswana	5.55	Belize	3.42	Libya	0.36	Brazil	0.62	Kazakhstan	0.03
Zambia	4.52	Algeria	3.24	Belize	0.32	Albania	0.62	Cuba	0.02
Chile	4.49	Sierra Leone	3.13	Pakistan	0.32	Namibia	0.61	Sudan	0.02
Argentina	4.30	Paraguay	3.11	Norway	0.26	Norway	0.60	Egypt	0.02
Georgia	4.21	Vanuatu	3.07	China	0.25	Colombia	0.58	Lithuania	0.02
Libya	4.18	Australia	2.88	Kenya	0.24	Chile	0.52	Bulgaria	0.02
Mozambique	4.17	Burkina Faso	2.78	St. Lucia	0.22	Bosnia & Herzegovina	0.44	Papua New Guinea	0.01
Cameroon	4.05	Eritrea	2.67	Vanuatu	0.22	Solomon Islands	0.44	Mexico	0.01
Sierra Leone	3.81	Guinea-Bissau	2.66	Netherlands Antilles	0.20	Venezuela	0.39	Spain	0.01
Belize	3.74	Cameroon	2.65	Iran, Islamic Rep	0.13	Mozambique	0.38	Hungary	0.01
Australia	3.59	Tanzania	2.44	Russian Federation	0.12	Zambia	0.35	Cyprus	0.01

Sources: NASA, WEC, Pollack, et al. (see Appendix 1)

Table 8: Top 35 Countries for Solar, Wind, Hydro, Geothermal by World Bank Region (by Years of Domestic Energy Consumption)

Region	Total	Solar	Wind	Hydro	Geothermal
Sub-Saharan Africa	17	21	6	11	7
East Asia / Pacific	4	5	3	6	4
Europe / Central Asia	3	0	6	5	14
Latin America / Caribbean	7	5	8	9	3
Middle East / North Africa	2	3	3	0	2
South Asia	0	0	1	1	0
All World Bank Regions	33	34	27	32	30

Table 9a: Top 35 Countries for Biofuels, by World Bank Region (by Years of Domestic Energy Consumption)

Region	Total	Sugar Crops	Savanna Tallgrass	Jatropha	Biogas
Sub-Saharan Africa	25	26	0	29	17
East Asia / Pacific	1	3	2	0	5
Europe / Central Asia	3	0	14	0	0
Latin America / Caribbean	5	6	3	3	9
Middle East / North Africa	0	0	5	2	1
South Asia	0	0	0	0	3
All World Bank Regions	34	35	24[a]	34	35

[a] of 27 total countries with significant savanna tallgrass potential

Table 9b: Annual Biofuel Resources, in Years of Total Domestic Energy Consumption

Country	Total	Country	Sugar	Country	Tallgrass	Country	Jatropha	Country	Biogas
Mongolia	448.68	Central Afr. Rep	41.63	Mongolia	448.51	Namibia	65.05	Uruguay	0.21
Central Afr.Rep	77.03	Uruguay	21.38	Kyrgyzstan	24.24	Mauritania	55.43	Mongolia	0.17
Namibia	72.39	Chad	15.91	Argentina	17.80	Chad	38.28	Mali	0.12
Mauritania	56.09	Bolivia	13.92	Kazakhstan	14.87	Central Afr. Rep.	35.32	Chad	0.11
Chad	54.30	Congo	13.50	Tajikistan	12.81	Mali	32.56	Sudan	0.11
Mali	41.49	Mozambique	11.11	Armenia	4.67	Niger	28.96	Paraguay	0.10
Niger	31.37	Zambia	10.09	Australia	3.23	Botswana	15.39	Bolivia	0.10
Uruguay	29.29	Mali	8.81	Syrian Arab Rep	2.86	Angola	13.83	Namibia	0.10
Congo	26.76	Gabon	8.20	New Zealand	1.87	Sudan	13.53	Burkina Faso	0.10
Kyrgyzstan	24.27	Angola	7.91	Canada	1.73	Congo	13.25	Central African Rep	0.08
Argentina	23.15	Paraguay	7.73	Moldova, Rep	1.59	Zambia	10.55	Ethiopia	0.08
Angola	21.75	Namibia	7.24	Russia	1.53	Congo, Dem Rep	8.31	Lao PDR	0.08
Zambia	20.65	Congo, Dem Rep	6.97	Oman	1.49	Mozambique	8.08	Mauritania	0.08
Sudan	20.28	Sudan	6.64	Jordan	1.36	Uruguay	7.70	Guinea-Bissau	0.07
Mozambique	19.20	Guyana	6.60	Georgia	1.35	Burkina Faso	7.28	Madagascar	0.07
Bolivia	17.35	Madagascar	6.23	Uzbekistan	1.33	Guinea-Bissau	6.75	Senegal	0.06
Botswana	16.86	Tanzania	5.98	Ukraine	1.16	Senegal	6.65	Nepal	0.06
Congo, DR	15.29	Burkina Faso	5.76	Chile	0.94	Eritrea	6.47	Myanmar	0.06
Kazakhstan	15.20	Cameroon	5.01	Turkey	0.88	Benin	5.61	Bangladesh	0.06
Burkina Faso	13.14	Benin	4.85	Iraq	0.83	Tanzania	5.51	Eritrea	0.06
Tajikistan	12.92	Cote d'Ivoire	4.81	United States	0.66	Yemen	4.93	Nicaragua	0.05
Paraguay	11.65	Guinea-Bissau	4.76	Romania	0.41	Zimbabwe	4.28	Tanzania	0.05
Guinea-Bissau	11.58	Argentina	4.72	China	0.33	Guinea	4.08	Niger	0.05
Tanzania	11.53	Togo	3.85	Iran, Islamic Rep	0.30	Paraguay	3.82	Vanuatu	0.05
Gabon	11.30	Sierra Leone	3.82	Azerbaijan	0.27	Togo	3.61	Brazil	0.05
Benin	10.50	Solomon Islands	3.38	Turkmenistan	0.14	Cameroon	3.58	Cameroon	0.04
Senegal	9.97	Senegal	3.26	Bulgaria	0.02	Kenya	3.50	Colombia	0.04
Cameroon	8.63	Guinea	2.87			Ethiopia	3.49	Benin	0.04
Madagascar	8.30	Malawi	2.73			Bolivia	3.33	Pakistan	0.04
Guyana	8.24	Ghana	2.53			Australia	3.22	Ecuador	0.04
Australia	7.73	Pap. New Guinea	2.51			Djibouti	3.22	Cambodia	0.04
C□e d'Ivoire	7.70	Cambodia	2.41			Gabon	3.09	Argentina	0.04
Togo	7.48	Niger	2.36			Côte d'Ivoire	2.87	Guyana	0.04
Guinea	6.98	Brazil	2.28			Sierra Leone	2.47	Kenya	0.04
Eritrea	6.86	Zimbabwe	2.15			Malawi	2.42	Morocco	0.04

Sources: See Appendix 1

Table 10: Table 10: Total Renewable Energy Potential
(by Years of Domestic Energy Consumption): Solar, Wind, Hydro, Geothermal, Biofuels

Sub-Saharan Africa	Total	E. Asia / Pac.	Total	Eur., Central Asia	Total	Lat. Amer / Carib	Total	ME, N Afr	Total	S. Asia	Total
Namibia	100.5	Mongolia	514.9	Kyrgyzstan	31.6	Bolivia	37.5	Yemen	11.1	Nepal	2.8
Central Afr. Rep.	90.9	P. New Guinea	12.6	Tajikistan	23.3	Uruguay	31.7	Libya	6.3	Pakistan	1.9
Mauritania	86.2	Solomon Is.	9.3	Kazakhstan	16.9	Argentina	27.5	Algeria	5.7	Sri Lanka	1.2
Chad	77.3	Lao PDR	8.8	Georgia	6.6	Guyana	19.3	Djibouti	4.6	Bangladesh	1.1
Mali	58.4	Cambodia	4.9	Armenia	6.0	Paraguay	19.1	Oman	3.9	India	0.9
Niger	50.4	Myanmar	3.9	Moldova, Rep	3.2	Peru	6.7	Morocco	3.8		
Congo	43.6	Vanuatu	3.3	Russia	3.1	Brazil	6.4	Syria	3.3		
Angola	27.9	Fiji	1.5	Latvia	2.3	Chile	5.5	Jordan	2.7		
Sudan	27.6	China	1.2	Ukraine	1.9	Colombia	4.4	Tunisia	2.0		
Zambia	25.2	Indonesia	1.2	Uzbekistan	1.7	Nicaragua	3.8	Egypt	1.2		
Congo, Dem Rep	24.7	Vietnam	0.8	Bosnia/ Herzegov.	1.7	Belize	3.8	Iran	0.9		
Mozambique	23.4	Thailand	0.7	Turkey	1.5	Venezuela	2.6	Lebanon	0.1		
Botswana	22.4	Philippines	0.6	Azerbaijan	1.4	Ecuador	2.6				
Gabon	20.3	Malaysia	0.6	Belarus	1.4	Honduras	2.2				
Burkina Faso	15.9	Samoa	0.5	Albania	1.4	Panama	1.9				
Madagascar	14.6	Tonga	0.2	Romania	1.4	Costa Rica	1.8				
Guinea-Bissau	14.2	Korea, Rep	0.1	Lithuania	1.3	Guatemala	1.3				
Tanzania	14.1			Turkmenistan	1.3	Mexico	1.1				
Cameroon	12.7			Croatia	0.9	Haiti	1.1				
Senegal	12.5			Serbia/ Montenegro	0.9	Antigua/ Barbuda	0.7				
Benin	12.5			Hungary	0.7	Dominican Rep	0.7				
Sierra Leone	10.1			Estonia	0.6	El Salvador	0.5				
Côte d'Ivoire	9.6			Bulgaria	0.6	St. Lucia	0.3				
Eritrea	9.5			Poland	0.5	Dominica	0.3				
Guinea	9.0			Slovakia	0.4	Jamaica	0.2				
Togo	8.9			Czech Rep	0.4	Saint Kitts/ Nevis	0.2				
Ethiopia	8.5			Slovenia	0.4	St. Vincent	0.1				
Zimbabwe	8.0			Macedonia, FYR	0.3	Grenada	0.1				
Kenya	6.5					Barbados	0.0				
Malawi	6.4					Trinidad/ Tobago	0.0				
Ghana	5.7										
Uganda	3.1										
Gambia	2.7										
Burundi	2.2										
Nigeria	2.0										
Swaziland	1.6										
Lesotho	1.4										
South Africa	1.3										
Equatorial Guinea	0.9										
Cape Verde	0.9										
Rwanda	0.7										
Comoros	0.2										

Table 11: Greenhouse Emissions from Deforestation and Other Land Clearing: Percent of Total Emissions

Sub-Saharan Afr.	%	E. Asia / Pacific	%	Eur., CA	%	LA / Carib.	%	ME / N. Africa	%	S. Asia	%
Liberia	94.5	P. New Guinea	94.3	Latvia	28.9	Belize	94.7	Tunisia	11.3	Nepal	79.6
Zambia	93.0	Myanmar	83.7	Albania	17.4	Guyana	90.2	Morocco	4.3	Sri Lanka	51.2
Congo, Dem Rep	86.0	Indonesia	83.6	Lithuania	17.2	Nicaragua	80.5	Lebanon	3.2	Afghanistan	28.4
Côte d'Ivoire	85.8	Malaysia	80.8	Estonia	8.8	Panama	80.1	Algeria	2.2	Pakistan	10.4
Benin	83.0	Lao PDR	76.4	Belarus	6.6	Peru	72.8	Egypt	1.7		
Malawi	80.4	Samoa	50.0	Slovakia	6.2	Guatemala	72.5	Iran, Islamic Rep	1.7		
Sierra Leone	76.9	Cambodia	45.0	Turkey	5.5	Bolivia	68.0	Yemen	1.6		
Cameroon	71.9	Philippines	41.6	Slovenia	5.4	Brazil	61.7	Libya	1.1		
Burundi	70.2	Solomon Islands	33.3	Russia	2.8	Ecuador	58.4				
Rwanda	66.4	Thailand	15.3			Honduras	56.6				
Madagascar	65.8	Fiji	2.9			Costa Rica	44.2				
Equatorial Guinea	63.8	Mongolia	1.8			Paraguay	44.1				
Togo	59.3					Colombia	39.8				
Uganda	59.3					Venezuela	37.6				
Zimbabwe	59.0					El Salvador	26.5				
Congo	58.6					Haiti	21.3				
Ghana	57.4					Chile	16.9				
Botswana	56.1					Jamaica	16.7				
Guinea	53.1					Argentina	16.0				
Nigeria	50.2					Mexico	15.9				
Central Afr. Rep	44.1										
Mozambique	38.4										
Guinea-Bissau	36.7										
Angola	34.4										
Gabon	26.7										
Sudan	24.1										
Mali	24.0										
Tanzania	19.7										
Kenya	18.5										
Namibia	17.6										
Chad	16.4										
Senegal	16.0										
Ethiopia	12.6										
Niger	5.4										
Burkina Faso	2.8										

Table 12: Underground Sequestration Potential: Years of Current Emissions

Sub-Saharan Africa	I	E. Asia / Pacific		Europe, Central Asia		Lat. Amer / Carib		ME, N Afr		S. Asia	
Gambia	9,939	Vietnam	1,678	Russia	184	Venezuela	165	Yemen	459	Bangladesh	202
Sao Tome	7,582	China	54	Albania	62	Suriname	112	Iran	428	Sri Lanka	68
Namibia	917	P. New Guinea	26	Croatia	58	Chile	99	Iraq	369	Pakistan	58
Guinea-Bissau	406	Thailand	24	Poland	26	Bolivia	60	Libya	353	India	24
Equatorial Guinea	268	Malaysia	22	Bulgaria	17	Mexico	41	Oman	329		
Gabon	182	Indonesia	13	Latvia	11	Ecuador	39	Algeria	270		
Angola	156	Myanmar	8	Estonia	8	Costa Rica	36	Egypt	96		
Senegal	106	Philippines	6	Romania	7	Argentina	35	Morocco	95		
Nigeria	101	Korea, Rep	3	Turkey	5	Haiti	34	Tunisia	56		
Congo	75			Serbia Montenegro	3	Colombia	21	Syria	48		
Chad	63			Lithuania	2	Jamaica	19	Lebanon	6		
South Africa	50			Czech Rep	1	Peru	15				
Sierra Leone	49					Dominican Rep	12				
Mozambique	42					Honduras	10				
Guinea	38					El Salvador	9				
Ghana	27					Brazil	7				
Liberia	25					Guyana	7				
Madagascar	15					Panama	6				
Djibouti	14					Nicaragua	4				
Tanzania	11					Guatemala	2				
Côte d'Ivoire	7					Belize	1				
Togo	5										
Sudan	4										
Kenya	4										
Benin	3										

Source: See Appendix 1

Table 13: Regional Distribution of Information on the Impact of Sea-Level Rise

Region	Mean Impact (GDP %)	Coastal Non-Island Countries Impacted	Island Countries	Landlocked Countries	Coastal, Impact Not Estimated	Total
Sub-Saharan Africa	2.5	27	5	15		47
East Asia / Pacific	5.6	10	9	2	1	22
Eastern Europe / Central Asia	1.1	7	0	14	7	28
Latin America / Caribbean	2.9	21	8	2	0	31
Middle East / North Africa	2.6	9	0	0	5	14
South Asia	1.8	4	1	3	0	8
Total	2.6	77	23	36	14	150

Table 14: Sea-Level Rise Impact Estimates: % of GDP

Sub-Saharan Africa	%	Eastern Europe / Central Asia	%	East Asia Pacific	%	Latin America Caribbean	%	Middle East North Africa	%	South Asia	%
Mauritania	17.48	Georgia	1.99	Vietnam	24.17	Suriname	19.86	Egypt	12.13	Bangladesh	3.84
Benin	14.76	Ukraine	1.54	Thailand	7.46	Guyana	14.47	Tunisia	4.87	Sri Lanka	1.57
Senegal	8.12	Estonia	1.53	China	5.59	Belize	5.56	Libya	2.41	India	1.57
Gambia	7.60	Turkey	1.10	Cambodia	4.95	Ecuador	4.37	Oman	1.36	Pakistan	0.33
Guinea	3.31	Poland	0.85	Indonesia	4.94	Uruguay	3.20	Djibouti	0.74		
Guinea-Bissau	1.83	Romania	0.56	Myanmar	3.97	Panama	1.71	Algeria	0.65		
Nigeria	1.58	Bulgaria	0.19	Philippines	2.12	Venezuela	1.50	Yemen	0.59		
Ghana	1.37			Malaysia	1.75	Argentina	1.38	Iran	0.59		
Liberia	1.25			Korea, Rep	0.60	Mexico	1.29	Morocco	0.48		
Côte d'Ivoire	1.21			P. New Guinea	0.11	Brazil	1.22				
Sierra Leone	0.96					Jamaica	1.16				
Mozambique	0.93					Peru	1.03				
Angola	0.76					Colombia	0.76				
Madagascar	0.67					El Salvador	0.60				
Gabon	0.42					Dominican Rep	0.55				
Ethiopia	0.37					Nicaragua	0.48				
Kenya	0.30					Honduras	0.40				
Togo	0.23					Haiti	0.30				
Equatorial Guinea	0.21					Costa Rica	0.29				
Somalia	0.19					Chile	0.18				
Cameroon	0.19					Guatemala	0.07				
Tanzania	0.11										
Congo	0.10										
Sudan	0.06										
Congo, Dem Rep	0.05										
South Africa	0.04										
Namibia	0.03										

Table 15: Weather Damage Index: Regional Distributions

Region	Min	Q1	Median	Q3	Max
South Asia	64.5	78.9	161.5	441.6	1,940.2
East Asia / Pacific	0.6	67.9	193.5	339.5	698.2
Sub-Saharan Africa	0.4	21.4	88.4	194.7	1,809.0
Latin America / Caribbean	1.3	30.7	68.6	191.0	818.5
Middle East / North Africa	0.0	11.1	17.6	29.3	585.9
Eastern Europe / Central Asia	0.1	1.0	4.7	17.1	140.0

Table 16: Weather Damage Index (WDI) by Region

SS Africa	WDI	E. Asia / Pacific	WDI	Lat. Am./Carib.	WDI	MENA	WDI	South Asia	WDI
Ethiopia	1,809.0	Tonga	698.2	Honduras	818.5	Iran	183.1	Bangladesh	1,940.2
Mozambique	1,133.8	Samoa	589.0	Antigua Barb.	387.0	Jordan	32.9	India	565.5
Sudan	999.2	Lao PDR	572.8	Belize	384.7	Tunisia	29.3	Sri Lanka	317.8
Djibouti	585.9	Solomon Islands	416.0	Haiti	253.7	Yemen	27.5	Pakistan	172.0
Botswana	536.2	Philippines	391.6	Nicaragua	241.5	Syria	18.4	Maldives	151.1
Somalia	496.8	Vanuatu	339.5	Venezuela	215.1	Algeria	17.6	Nepal	84.4
Mauritania	432.9	Fiji	310.4	St. Lucia	212.2	Oman	14.5	Afghanistan	73.5
Malawi	411.2	Vietnam	234.8	Dominican Rep	191.0	Morocco	13.3	Bhutan	64.5
Zimbabwe	393.6	China	222.6	Dominica	181.9	Iraq	11.1		
Swaziland	351.7	Cambodia	213.4	Bolivia	124.1	Lebanon	5.6		
Chad	260.1	Marshall Islands	193.5	Jamaica	117.3	Egypt	3.7		
Benin	196.9	Mongolia	187.7	Guyana	99.4	Libya	0.0		
Niger	194.7	Kiribati	150.9	Costa Rica	76.7				
Comoros	186.3	Micronesia	121.3	St. Kitts Nevis	74.1				
Madagascar	162.6	Thailand	106.0	Peru	73.0				
Gambia	158.4	P. New Guinea	67.9	Argentina	68.6				
Senegal	155.5	Korea, Rep	64.1	Paraguay	68.0				
Zambia	137.5	Myanmar	27.2	Brazil	61.8				
Mauritius	125.0	Indonesia	19.9	Chile	54.5				
Lesotho	112.6	Malaysia	11.7	Ecuador	49.3				
Rwanda	107.3	Timor-Leste	0.6	Colombia	41.7				
Sao Tome	104.5			El Salvador	36.7				
Kenya	102.3			St. Vincent	34.2				
Eritrea	89.5			Barbados	30.7				
Burkina Faso	87.2			Guatemala	29.5				
Namibia	77.4			Mexico	26.1				
Tanzania	69.7			Panama	23.0				
Mali	64.0			Grenada	8.0				
Angola	62.2			Trinidad Tobago	7.6				
Togo	58.5			Uruguay	5.8				
Liberia	55.2			Suriname	1.3				
Ghana	32.9								

Burundi	28.5								
Uganda	25.3								
Seychelles	21.8								
CAR	21.4								
Guinea-Bissau	18.5								
Nigeria	15.1								
Cape Verde	13.7								
South Africa	10.4								
Sierra Leone	9.1								
Guinea	5.7								
Congo	5.7								
Cameroon	5.7								
Congo,, DR	5.0								
Gabon	1.4								
Cote d'Ivoire	0.4								

Table 17: Correlations Between Country Indicators

	Non-Renewable Energy	Renewable Energy	Employment Vulnerability	Sequestration (Storage)	Sequestration (Reduced Deforestation)	Sea Level Rise Impact
Renewable Energy	-0.07*					
Employment Vulnerability	-0.02	-0.45*				
Sequestration (Storage)	-0.56*	0.03	0.07			
Reduced Deforestation	0.04	0.49*	-0.35*	-0.16*		
Sea Level Rise Impact	0.08*	-0.42*	0.33*	0.35*	-0.30*	
Weather Impact	0.20*	0.36*	-0.30*	-0.13*	0.29*	-0.13*

* Denotes significance at 95%

Table 18: Alternative Orientation Index Weights

Weighting Emphasis	Renewable Energy Resources	Sequestration Potential	Sea Level Rise	Weather Damage	Non-Renewable Energy Resources	Employment Vulnerability
Energy Resources	0.3	0.1	0.1	0.1	0.3	0.1
Impact Vulnerability	0.1	0.1	0.3	0.3	0.1	0.1
Neutral	0.167	0.167	0.167	0.167	0.167	0.167
Positive Source Factors	0.3	0.3	0.1	0.1	0.1	0.1
Negative Source Factors	0.1	0.1	0.1	0.1	0.3	0.3

Table 19: Country Orientation Toward a Global Protocol: Robustness in Different Scenarios

				Counts			Index Values				
Region	Subregion	Country	Group	1	2	3	I1	I2	I3	I4	I5
AFR	East Africa	Ethiopia	High	5	0	0	1	1	1	1	1
AFR	East Africa	Madagascar	High	4	1	0	1	1	1	1	2
AFR	Southern Africa	Mozambique	High	4	1	0	1	1	1	1	2
AFR	Sahelian Africa	Mauritania	High	4	1	0	1	1	1	1	2
AFR	Coastal West Africa	Benin	High	5	0	0	1	1	1	1	1
AFR	Coastal West Africa	Senegal	High	5	0	0	1	1	1	1	1
AFR	Coastal West Africa	Guinea-Bissau	High	4	1	0	1	1	1	1	2
AFR	Coastal West Africa	Ghana	High	4	1	0	1	1	1	1	2
AFR	Coastal West Africa	Gambia	High	4	1	0	1	1	1	1	2
AFR	Coastal West Africa	Togo	High	3	2	0	1	2	1	1	2
AFR	Coastal West Africa	Guinea	High	3	2	0	1	2	1	1	2
AFR	Coastal West Africa	Sierra Leone	High	3	2	0	1	2	1	1	2
AFR	Central Africa	Zambia	Middle	2	3	0	1	2	2	1	2
AFR	Central Africa	Congo, Dem Rep	Middle	2	2	1	1	3	2	1	2
AFR	Central Africa	Angola	Middle	1	3	1	2	2	2	1	3
AFR	Central Africa	Central African Rep	Middle	1	3	1	1	3	2	2	2
AFR	Central Africa	Cameroon	Middle	1	3	1	1	3	2	2	2
AFR	East Africa	Tanzania	Middle	2	3	0	1	2	2	1	2
AFR	East Africa	Sudan	Middle	2	2	1	2	1	2	1	3
AFR	East Africa	Kenya	Middle	1	4	0	1	2	2	2	2
AFR	East Africa	Malawi	Middle	1	4	0	1	2	2	2	2
AFR	Sahelian Africa	Niger	Middle	1	4	0	1	2	2	2	2
AFR	Sahelian Africa	Mali	Middle	1	3	1	1	3	2	2	2
AFR	Sahelian Africa	Burkina Faso	Middle	1	3	1	1	3	2	2	2
AFR	Sahelian Africa	Chad	Middle	1	3	1	2	2	2	1	3
AFR	Coastal West Africa	Côte d'Ivoire	Middle	2	3	0	1	2	2	1	2
AFR	Central Africa	Congo	Low	1	0	4	3	3	3	1	3
AFR	Central Africa	Burundi	Low	0	2	3	2	3	3	2	3
AFR	Central Africa	Rwanda	Low	0	0	5	3	3	3	3	3
AFR	East Africa	Uganda	Low	0	2	3	2	3	3	2	3
AFR	Southern Africa	Zimbabwe	Low	0	3	2	2	2	3	2	3
AFR	Southern Africa	Lesotho	Low	0	1	4	2	3	3	3	3
AFR	Coastal West Africa	Nigeria	Low	0	2	3	3	2	3	2	3
AFR	Coastal West Africa	Equatorial Guinea	Low	0	0	5	3	3	3	3	3
EAP	Southeast Asia	Philippines	High	4	1	0	1	1	1	2	1
EAP	Southeast Asia	Thailand	Middle	2	3	0	2	1	1	2	2
EAP	Southeast Asia	Indonesia	Middle	1	4	0	2	1	2	2	2
EAP	China	China	Low	1	2	2	3	1	2	2	3
EAP	Northeast Asia	Korea, Rep	Low	1	2	2	3	2	2	3	1
ECA	Eastern Europe	Georgia	High	4	1	0	1	1	1	2	1
ECA	Middle East	Turkey	Middle	0	5	0	2	2	2	2	2
ECA	Western Asia	Tajikistan	Middle	1	4	0	1	2	2	2	2
ECA	Eastern Europe	Moldova, Rep	Low	0	3	2	2	3	3	2	2
ECA	Eastern Europe	Armenia	Low	0	3	2	2	3	3	2	2
ECA	Eastern Europe	Belarus	Low	0	2	3	2	3	3	3	2
ECA	Eastern Europe	Romania	Low	0	1	4	2	3	3	3	3
ECA	Eastern Europe	Macedonia, FYR	Low	0	0	5	3	3	3	3	3
ECA	Eastern Europe	Ukraine	Low	0	0	5	3	3	3	3	3
ECA	Eastern Europe	Poland	Low	0	0	5	3	3	3	3	3
ECA	Eastern Europe	Serbia and Montenegro	Low	0	0	5	3	3	3	3	3
ECA	Eastern Europe	Hungary	Low	0	0	5	3	3	3	3	3
ECA	Eastern Europe	Bulgaria	Low	0	0	5	3	3	3	3	3
ECA	Eastern Europe	Slovakia	Low	0	0	5	3	3	3	3	3

				Counts			Index Values				
Region	Subregion	Country	Group	1	2	3	I1	I2	I3	I4	I5
ECA	Eastern Europe	Czech Rep	Low	0	0	5	3	3	3	3	3
ECA	Eastern Europe	Estonia	Low	0	0	5	3	3	3	3	3
ECA	Western Asia	Kyrgyzstan	Low	1	2	2	1	3	3	2	2
ECA	Western Asia	Azerbaijan	Low	0	0	5	3	3	3	3	3
ECA	Western Asia	Kazakhstan	Low	0	0	5	3	3	3	3	3
ECA	Western Asia	Uzbekistan	Low	0	0	5	3	3	3	3	3
ECA	Western Asia	Turkmenistan	Low	0	0	5	3	3	3	3	3
LCR	Andean South America	Peru	High	5	0	0	1	1	1	1	1
LCR	Andean South America	Ecuador	High	3	2	0	2	1	1	1	2
LCR	Central America	Panama	High	5	0	0	1	1	1	1	1
LCR	Central America	Belize	High	5	0	0	1	1	1	1	1
LCR	Central America	Honduras	High	5	0	0	1	1	1	1	1
LCR	Central America	Costa Rica	High	5	0	0	1	1	1	1	1
LCR	Central America	Nicaragua	High	5	0	0	1	1	1	1	1
LCR	Central America	Mexico	High	3	2	0	2	1	1	2	1
LCR	Caribbean Islands	Dominican Rep	High	3	2	0	2	1	1	2	1
LCR	Caribbean Islands	Jamaica	High	3	2	0	2	1	1	2	1
LCR	Northern South America	Guyana	High	5	0	0	1	1	1	1	1
LCR	Northern South America	Brazil	High	3	2	0	2	1	1	1	2
LCR	Southern South America	Argentina	High	5	0	0	1	1	1	1	1
LCR	Southern South America	Chile	High	5	0	0	1	1	1	1	1
LCR	Southern South America	Paraguay	High	4	1	0	1	2	1	1	1
LCR	Southern South America	Uruguay	High	3	2	0	1	2	1	2	1
LCR	Andean South America	Bolivia	Middle	2	3	0	2	2	1	1	2
LCR	Central America	Guatemala	Middle	1	4	0	2	2	2	2	1
LCR	Central America	El Salvador	Middle	1	4	0	2	2	2	2	1
LCR	Caribbean Islands	Haiti	Middle	2	3	0	2	1	1	2	2
LCR	Northern South America	Venezuela	Middle	3	1	1	3	1	1	1	2
LCR	Andean South America	Colombia	Low	0	3	2	3	2	2	2	3
MNA	East Africa	Djibouti	High	5	0	0	1	1	1	1	1
MNA	North Africa	Tunisia	High	3	2	0	2	1	1	1	2
MNA	Middle East	Yemen	Middle	1	3	1	2	2	2	1	3
MNA	Middle East	Oman	Middle	0	4	1	3	2	2	2	2
MNA	North Africa	Egypt	Middle	0	5	0	2	2	2	2	2
MNA	North Africa	Algeria	Low	0	3	2	3	2	2	2	3
MNA	North Africa	Libyan Arab Jamahiriya	Low	0	1	4	3	3	3	2	3
MNA	North Africa	Morocco	Low	0	1	4	3	3	3	2	3
MNA	Western Asia	Iran, Islamic Rep	Low	0	2	3	3	2	3	2	3
SAR	Southern Asia	Bangladesh	Middle	1	3	1	2	1	2	2	3
SAR	Western Asia	Pakistan	Middle	0	4	1	2	2	2	2	3
SAR	Southern Asia	Nepal	Low	0	2	3	2	3	3	2	3
SAR	India	India	Low	0	1	4	3	2	3	3	3
OTH	AustraliaNZ	New Zealand	High	5	0	0	1	1	1	1	1
OTH	AustraliaNZ	Australia	High	3	2	0	2	1	1	1	2
OTH	Western Europe	Denmark	High	3	2	0	2	1	1	2	1
OTH	North America	Canada	Middle	1	3	1	3	2	2	1	2
OTH	Northeast Asia	Japan	Middle	2	2	1	2	1	2	3	1
OTH	Western Europe	Netherlands	Middle	3	1	1	2	1	1	3	1
OTH	Western Europe	Spain	Middle	2	2	1	2	1	2	3	1
OTH	Western Europe	Ireland	Middle	1	4	0	2	2	2	2	1
OTH	Western Europe	France	Middle	1	3	1	2	2	2	3	1
OTH	Western Europe	Portugal	Middle	1	3	1	2	2	2	3	1
OTH	Western Europe	Italy	Middle	1	3	1	2	2	2	3	1
OTH	Western Europe	Finland	Middle	1	3	1	2	2	2	3	1
OTH	Middle East	Qatar	Low	0	0	5	3	3	3	3	3

				Counts			Index Values				
Region	Subregion	Country	Group	1	2	3	I1	I2	I3	I4	I5
OTH	Middle East	Kuwait	Low	0	0	5	3	3	3	3	3
OTH	Middle East	United Arab Emirates	Low	0	0	5	3	3	3	3	3
OTH	North America	United States	Low	0	2	3	3	2	3	3	2
OTH	Southeast Asia	Brunei Darussalam	Low	0	0	5	3	3	3	3	3
OTH	Western Europe	Belgium	Low	1	2	2	3	2	2	3	1
OTH	Western Europe	Sweden	Low	1	2	2	2	3	2	3	1
OTH	Western Europe	Germany	Low	1	2	2	3	2	2	3	1
OTH	Western Europe	United Kingdom	Low	1	2	2	3	2	2	3	1
OTH	Western Europe	Luxembourg	Low	1	0	4	3	3	3	3	1
OTH	Western Europe	Switzerland	Low	1	0	4	3	3	3	3	1
OTH	Western Europe	Austria	Low	1	0	4	3	3	3	3	1
OTH	Western Europe	Greece	Low	0	2	3	3	2	3	3	2

Table 20: Climate Change Dimensions: Correlations (N=120)

	Renewable Energy Resources	Sequestration Potential	Sea Level Rise	Weather Damage	Non-Renewable Energe Resources	Employment Vulnerability
Renewable Energy Resources	1					
Sequestration Potential	0.3831	1				
Sea Level Rise	-0.2374	0.1801	1			
Weather Damage	0.4490	0.2736	-0.1049	1		
Non-Renewable Energy Resources	0.0330	-0.2833	-0.0939	0.1562	1	
Employment Vulnerability	-0.4729	-0.2368	0.3471	-0.3100	-0.0841	1

Table 21: Index Correlations: Alternative Weights (N=120)

Index Weights						Correlations					
Renewable Energy Resources	Sequestration Potential	Sea Level Rise	Weather Damage	Non-Renewable Energy Resources	Employment Vulnerability	Index	A	B	C	D	E
0.3	0.1	0.1	0.1	0.3	0.1	A	1				
0.1	0.1	0.3	0.3	0.1	0.1	B	0.7019	1			
0.167	0.167	0.167	0.167	0.167	0.167	C	0.8498	0.9333	1		
0.3	0.3	0.1	0.1	0.1	0.1	D	0.7836	0.7508	0.8377	1	
0.1	0.1	0.1	0.1	0.3	0.3	E	0.6885	0.6373	0.7881	0.3865	1

Table 22: Regional Summary of Results

Region	High	Middle	Low	Total
AFR	12	14	8	34
EAP	1	2	2	5
ECA	1	2	18	21
LCR	16	5	1	22
MNA	2	3	4	9
SAR	0	2	2	4
OTHER	3	9	13	25
Total	35	37	48	120

Table 23: Total CO_2 Emissions in 2000 (Mt)

	High	Medium	Low
China			4,890.4
Indonesia		3,065.6	
Brazil	2,223.2		
India			1,843.8
Other	2,379.3	3,268.8	4,243.4
Total	4,602.5	6,325.4	10,977.6
Percent	21.0	28.9	50.1

Source: World Resources Institute, Climate Analysis Indicators Tool (CAIT).
Total GHG Emissions, including land-use change http://cait.wri.org/cait.php

Table 24: Countries by Source and Impact Vulnerability

<table>
<tr><th rowspan="2">Source Vulnerability</th><th colspan="3">Impact Vulnerability</th></tr>
<tr><th>High</th><th>Medium</th><th>Low</th></tr>
<tr><td>High</td><td>Bangladesh
China
Greece
India
Iran, Islamic Rep
Jordan
Liberia
Pakistan
Somalia
Sudan</td><td>Afghanistan
Bhutan
Iraq
Korea, Rep
Lesotho
Morocco
Nigeria
Poland
Rwanda
Swaziland
Ukraine
United States
Zimbabwe</td><td>Andorra
Azerbaijan
Bahrain
Bosnia and Herzegovina
Brunei Darussalam
Bulgaria
Burundi
Czech Rep
Equatorial Guinea
Estonia
Greenland
Hungary
Israel
Kazakhstan
Kuwait
Liechtenstein
Macedonia, FYR
Monaco
Qatar
Romania
Russian Federation
San Marino
Saudi Arabia
Serbia and Montenegro
Singapore
Slovakia
South Africa
Taiwan
Turkmenistan
United Arab Emirates
Uzbekistan
West Bank and Gaza</td></tr>
</table>

Source Vulnerability	Impact Vulnerability		
	High	Medium	Low
Medium	Australia Canada Cuba Ecuador Egypt Eritrea Finland Gambia Haiti Indonesia Jamaica Japan Korea, Dem People's Rep Lithuania Mauritania Netherlands Spain Thailand Venezuela Vietnam	Algeria Angola Belgium Burkina Faso Chad Colombia France Germany Italy Kenya Malawi Malaysia Mali Moldova, Rep Nepal Niger Oman Portugal Syrian Arab Rep Tanzania United Kingdom Yemen	Armenia Austria Belarus Central African Rep Congo Lebanon Libyan Arab Jamahiriya Luxembourg Norway Slovenia Sweden Switzerland Uganda
Low	Albania Argentina Belize Benin Botswana Brazil Cambodia Denmark Djibouti Dominican Rep Ethiopia Georgia Ghana Guyana Honduras Lao People's Dem Rep Madagascar Mozambique Myanmar New Zealand Nicaragua Peru Philippines Senegal Sri Lanka Tunisia	Bolivia Chile Costa Rica Cyprus El Salvador Guatemala Guinea Guinea-Bissau Ireland Mexico Mongolia Namibia Panama Papua New Guinea Paraguay Sierra Leone Suriname Tajikistan Togo Uruguay Zambia	Cameroon Congo, Dem Rep Croatia Côte d'Ivoire Gabon Iceland Kyrgyzstan Latvia Turkey

Table 25: Emissions (Mt) by Source and Impact Vulnerability

		Impact				
		High	Medium	Low		Total
Source	High	7,964 (19.4%)	8,586 (21.0%)	4,384 (10.7%)		20,934 (51.1%)
	Medium	7,556 (18.4%)	4,779 (11.7%)	548 (1.3%)		12,884 (31.5%)
	Low	4,491 (11.0%)	1,634 (4.0%)	1,022 (2.5%)		7,146 (17.4%)
	Total	20,010 (45.9%)	14,999 (39.5%)	5,954 (14.6%)		40,963

Figure 1: Global Distribution of Geothermal Resources (Pollack et al. 1993)
(Heat flow at measurement points in mW/m^2)

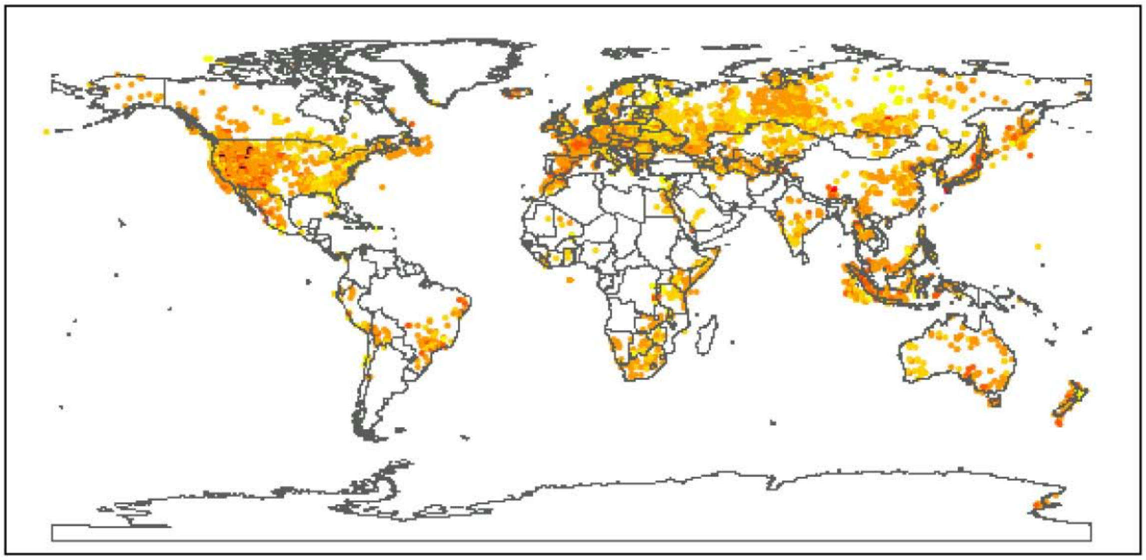


Figure 2: Global Distribution of Solar Resources (NASA)
(Yearly average insolation in kwh/m^2/day)

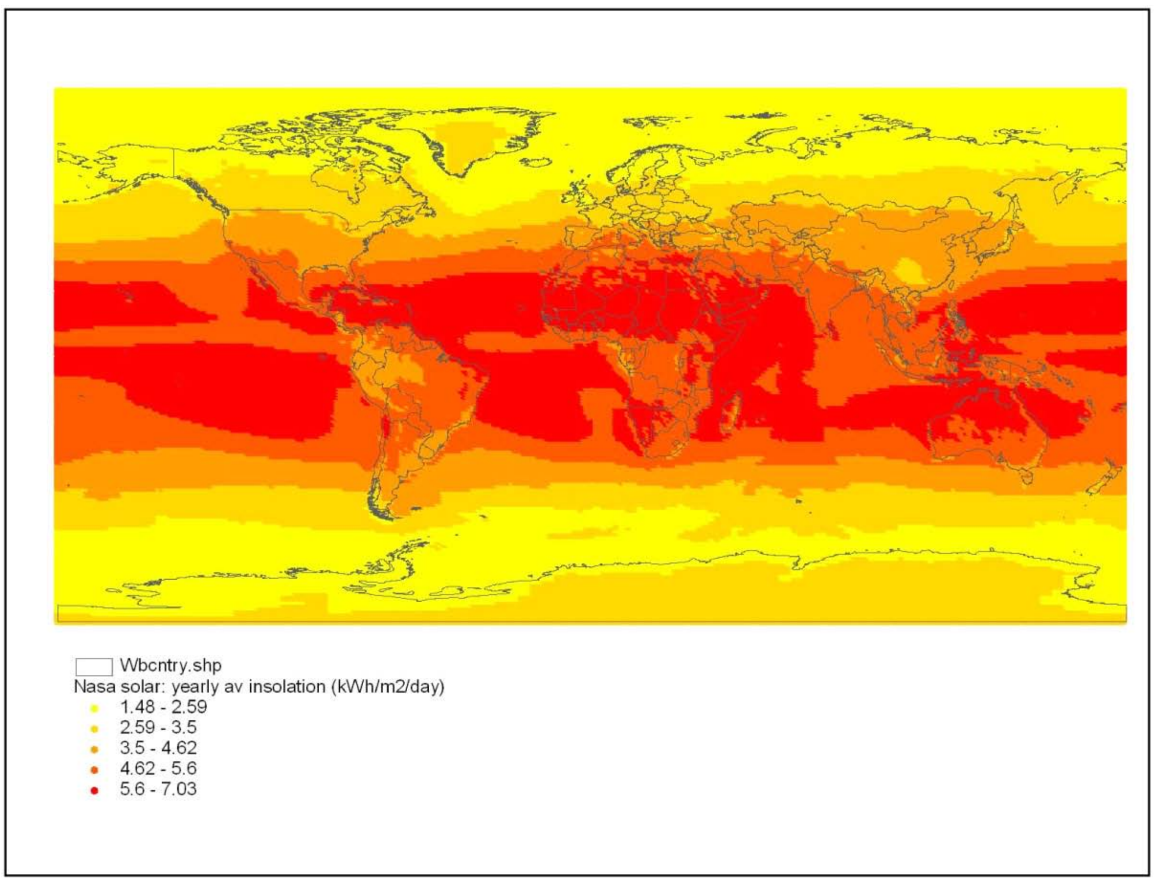


Figure 3: Global Distribution of Wind Resources (Archer and Jacobson, 2005)
(Yearly average wind speed at 80 meters (m/s))

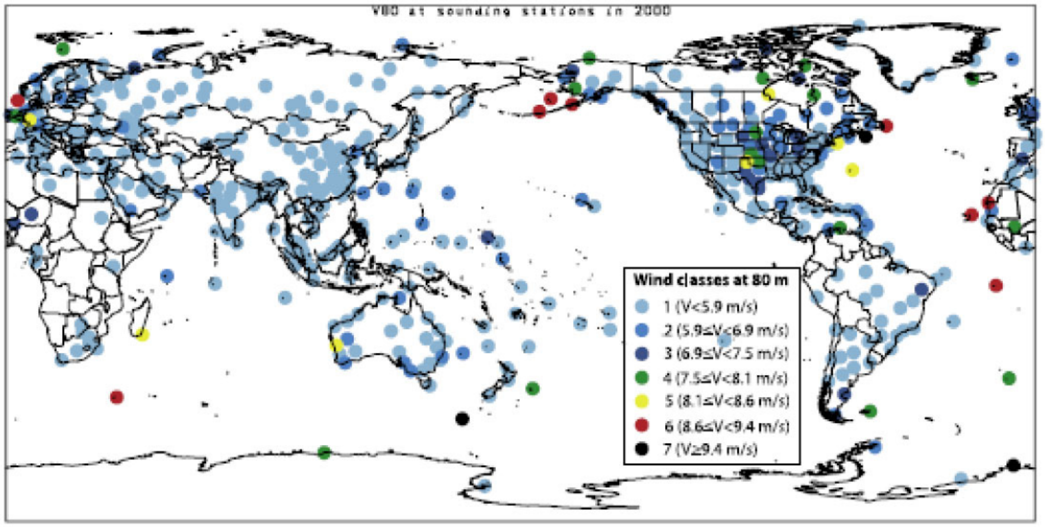


Figure 4: Estimated Potential Renewable Energy Production versus Current Consumption

Broken lines indicate 10%, 50%, 200% and 1000% of current use.
Current consumption / estimated potential renewable energy in mtoe/year.

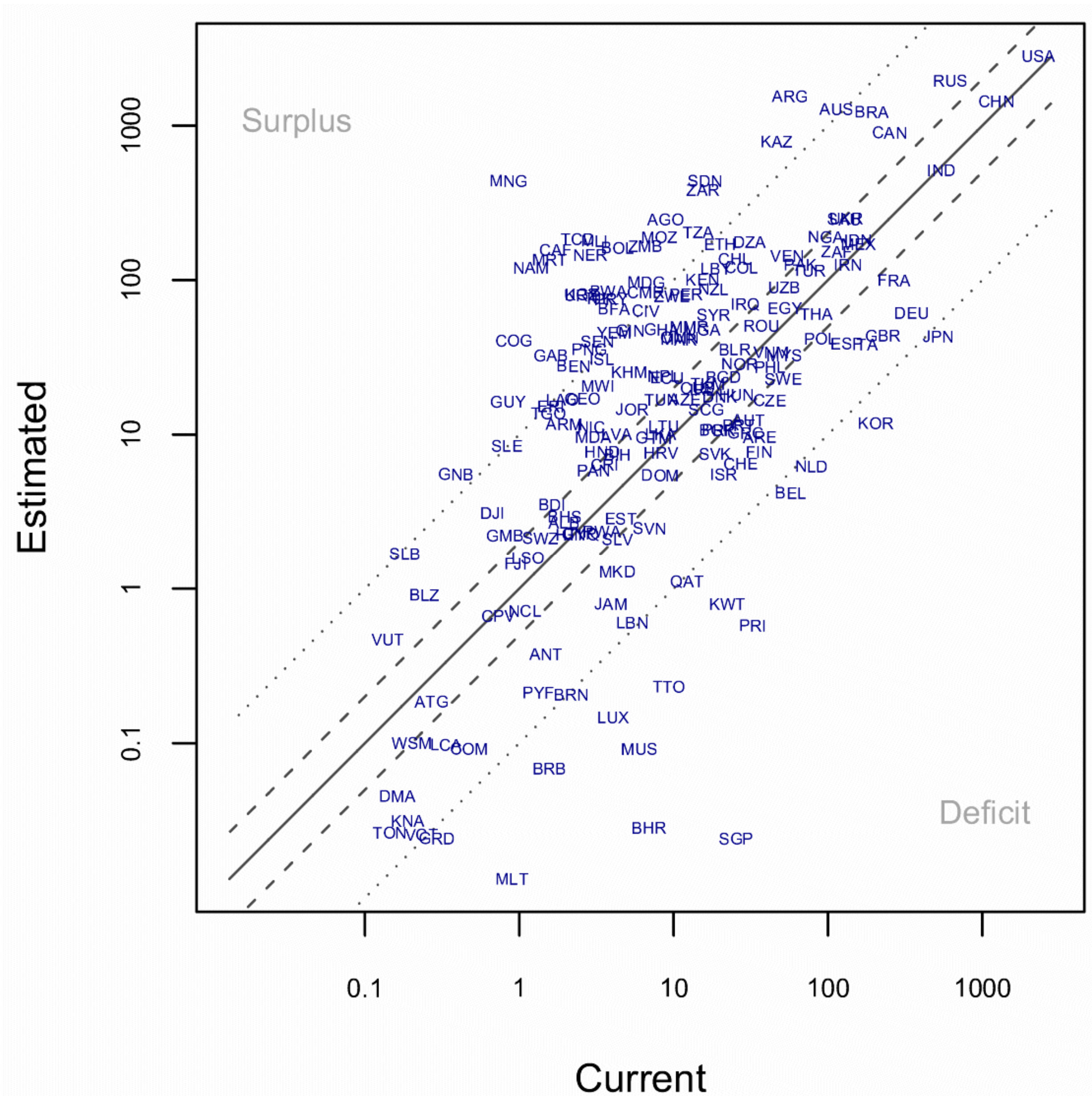


Figure 5: Estimated Potential Renewable Energy Production versus Current Consumption (World Bank Regions)

Broken lines indicate 10%, 50%, 200% and 1000% of current use.
Current consumption / estimated potential renewable energy in mtoe/year.

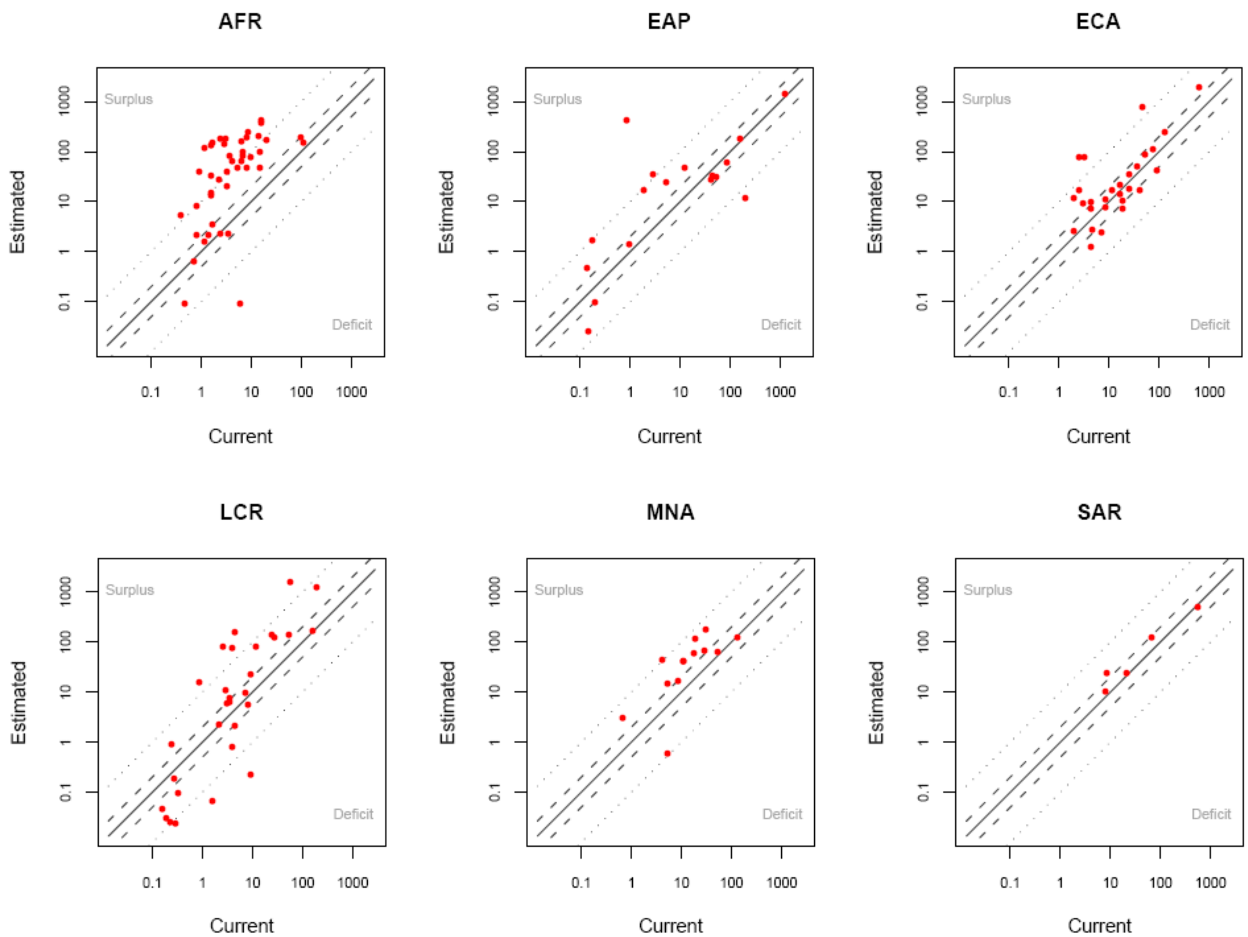
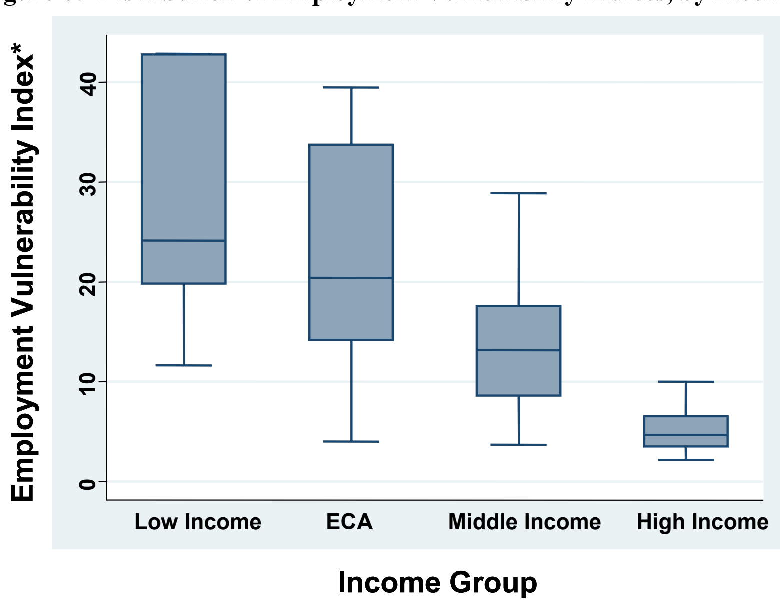
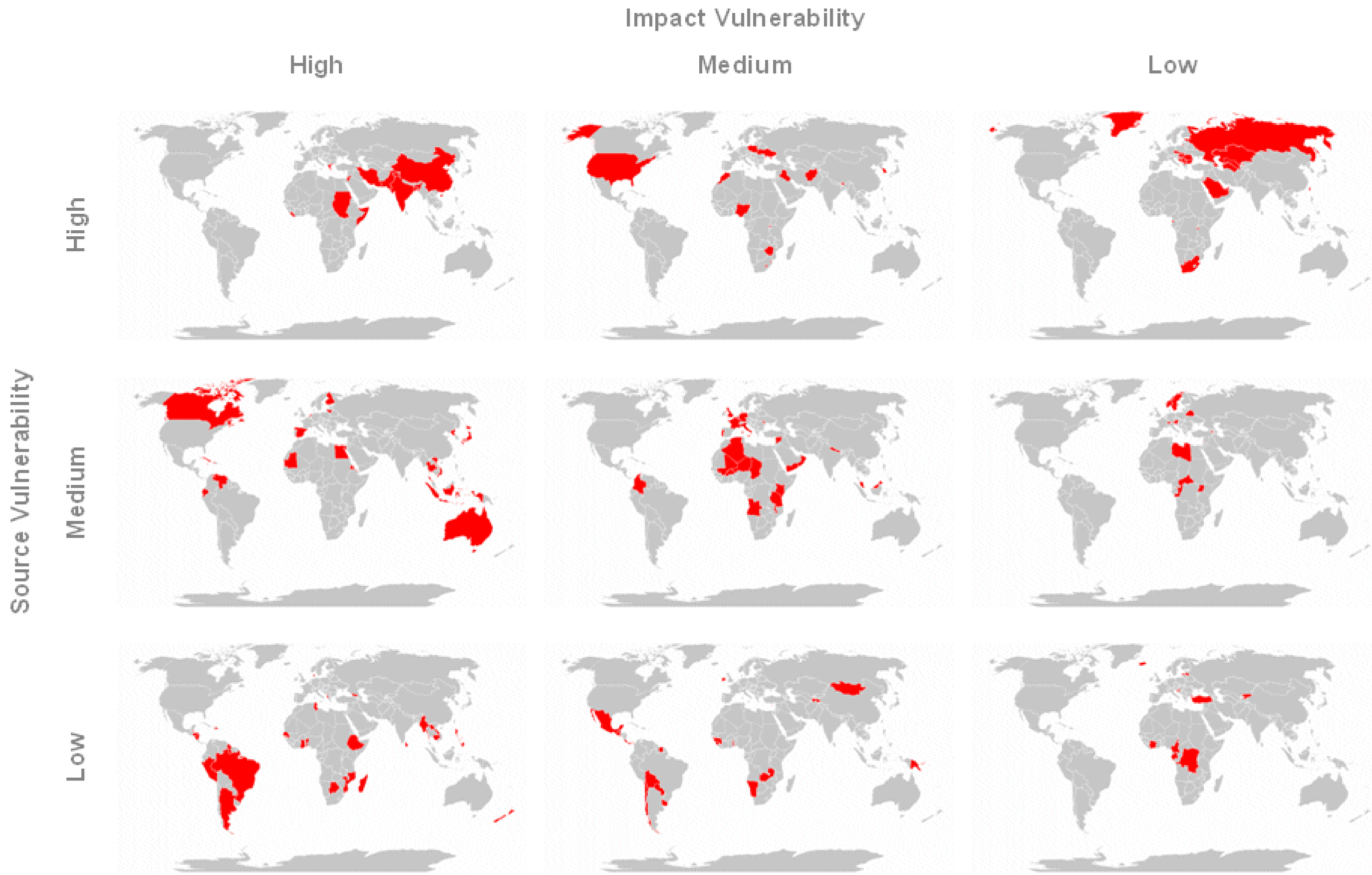


Figure 6: Distribution of Employment Vulnerability Indices, by Income Group



*** Top value (100) dropped from EVI**

Figure 7: Countries by Source and Impact Vulnerability



Appendix 1: Data sources and references

Notes: Mtoe = million tones of oil equivalent
Energy conversion factors from
http://www.energymarkets.eu.com/ documents/Conversionfactors_000.xls

1. Natural Gas: Proved Reserves at end 2005

Source: BP Statistical Review of World Energy, 2006
(http://www.bp.com/productlanding.do?categoryId=91&contentId=7017990)

Method: Reserves tabulated in trillion cubic meters
Conversion to Mtoe via current production ratio (Mtoe/cubic meters) for each country.

2. Oil: Proved Reserves at end 2005

Source: BP Statistical Review of World Energy, 2006
(http://www.bp.com/productlanding.do?categoryId=91&contentId=7017990)

Method: Direct transcription from BP spreadsheet (Converted to Mtoe)

3. Coal: Proved reserves at end 2005

Source: BP Statistical Review of World Energy, 2006
(http://www.bp.com/productlanding.do?categoryId=91&contentId=7017990)

Method: Reserves tabulated in millions of tons
Conversion to Mtoe via current production ratio (Mtoe/mt coal prod.) for each country.

4. Natural Bitumen, Oil Shale

Source: World Energy Council. 2001. Survey of Energy Resources
http://www.worldenergy.org/wec-geis/publications/reports/ser/shale/shale.asp

Method: Oil Shale: Proved recoverable reserves plus estimated additional reserves (Mtoe). Table 3.1 Oil shale: resources, reserves and production at end-1999
Note: Only economically recoverable reserves are used in the calculation since the technology is relatively experimental (and costly) with few examples of actual production-scale implementation.

Source: World Energy Council. 2001. Survey of Energy Resources
http://www.worldenergy.org/wec-geis/publications/reports/ser/bitumen/bitumen.asp

Method: Natural Bitumen: Proved amount in place plus estimated additional reserves (Mtoe). Table 4.1 Natural bitumen: resources, reserves and production at end-1999

5. Geothermal Potential Energy

Data Source: Pollack, Henry N.; Hurter, Suzanne J.; Johnson, Jeffrey R. 1993. "Heat flow from the earth's interior - Analysis of the global data set." *Reviews of Geophysics*. vol. 31, no. 3, p. 267-280.

a) Initial screen of potentially exploitable sites from the above database:

- Remove sites where the temperature gradient is larger than 110K/m (volcanoes, etc) (leaving 10703 sites out of 14238).

- Calculate the minimum temperature gradient necessary to produce electricity:
- Depth = dT/TGradient = 150K/TGradient
- If no temperature gradient was given, the following calculation was made:

  Depth = 150K*conductivity/heat flow

- If no conductivity value was given: an arbitrary conductivity of 2.5 was chosen (Granite)
- Keep sites with location depths of <6 km (leaving 8040 sites out of 10703)

b) Calculate spacing requirements for exploitation:

- Site observations in mW/m^2 (milliwatts/sq. meter) by country
- Calculate total number of observation sites per country
- Divide into area to get sq. km./ site
- Set maximum spacing at 25000 sq. km./site
  (Spacing procedure incorporates area represented by site)

Calculate a "reasonable" coverage extrapolation area for one sample drilling. Rationale: When mapped, the data points clearly reflect greater drilling frequency in countries that are believed to have more thermal resources. Average heat flow cannot be simply calculated from the sample points and multiplied by national area since this would clearly overestimate the total for countries where sampling is sparse (e.g., Niger). After looking at average area per sample for all the countries, and focusing where coverage is near-total (e.g., US, South Africa), we arrive at 25,000 sq. km. per sample drilling as a reasonable estimate. For countries with smaller sample areas per sample (which we call <u>spacing</u>), we use the actual number, otherwise, we truncate at 25,000).

c) Generate estimated heat (power) flow associated with each site as follows:

- Factors multiplied together to obtain heat energy associated with each site
  Heatkw=heatflow/1,000,000 (1 kW = 10^6 mW): Conversion to kW/m^2
  Spacing (Area in sq. km.) x 1,000,000 (Conversion to m^2)
    [1 sq. km. = 10^3 meters x 10^3 meters]
    [After cancellation, heatkw = heatflow x spacing]
- Heatkw totaled across sites for each country to get country kW.

- Conversion to heat potential in annual mtoe:
  Heat potential = Heatkw x 24 (hours/day) x 365.25 (days/year) x $8e^{-11}$
  (kWh => mtoe)

d) Assumptions:
Current Capacity Factor: Country-specific capacity factor from Lund, Freeston and Boyd (2005) below
Sensitivity ranges:
  Low: 10% greater capacity factor (max. 100%)
  High: 30% greater capacity factor (max. 100%)
Conversion potential:
  Low: 5% of total heat potential
  High: 15% of total heat potential; set at current Swiss conversion percent, on the assumption that Swiss exploitation is near the current technical limit]
  [Exception for Turkey, which is currently 0.68]

Data Source: Lund, J., D. Freeston and T. Boyd. 2005. "Direct Application of Geothermal Energy: 2005 Worldwide Review," *Geothermics* 34: 691-727 (Table 1).

e) Final calculation:

Heatmtoe = Capacity Factor x Conversion potential x heat potential

5. Potential Wind Power

Onshore wind potential:

Data Sources:

NASA Surface meteorology and Solar Energy: Global Data
Monthly Averaged Wind Speed At 50 m Above The Surface Of The Earth (m/s)
Site URL: http://eosweb.larc.nasa.gov/sse/

Archer, C. and M. Jacobson (2005) Evaluation of global wind power, Journal of Geophysical Research, Vol. 110, D12110, doi:10.1029/2004JD005462.
http://www.stanford.edu/group/efmh/winds/global_winds.html

Urban areas subtracted as they are probably not suitable for large turbine siting. Urban areas GIS data: Global Rural-Urban Mapping Project (GRUMP): Urban/Rural Extents Center for International Earth Science Information Network (CIESIN), Columbia University; International Food Policy Research Institute (IPFRI); the World Bank; and Centro Internacional de Agricultura Tropical (CIAT);2004. Palisades, NY: CIESIN, Columbia University. Available at http://sedac.ciesin.columbia.edu/gpw/

a) Wind speed area calculation:

i) Calculation of wind speed at 80m elevation from NASA 50m

Use of the Shear expression: http://www.windpower.org/en/tour/wres/shear.htm

$$v = v_{ref} \ln(z/z_0)/\ln(z_{ref}/z_0)$$

where v = wind speed at height z above ground level
v_{ref} = reference speed, i.e. a wind speed we already know at height z_{ref}
z = height above ground level for the desired velocity, v (i.e., 80 m)
z_0 = roughness length in the current wind direction.
Roughness lengths may be found in the Reference Manual at http://www.windpower.org/en/tour/wres/shear.htm.
z_{ref} = reference height, i.e. the height where we know the exact wind speed v_{ref}

Roughness class = 1.55 and roughness length = 0.055 corresponding to following landscape type: Agricultural land with some houses and 8 meters tall sheltering hedgerows with a distance of approximately 1250 meters
http://www.windpower.org/en/stat/unitsw.htm#roughness

ii) Merge with Archer and Jacobson 80m wind speed data

iii) Spatial interpolation to raster using: Inverse Distance Weighted (IDW):
Neighbors: 3, at 0.1 degree resolution (approx 11 km at the equator).

iv) Re-classification into 7 wind classes (meters/second): (Archer and Jacobsen (2005)):

	Class 1	< 5.9
5.9	< Class 2	< 6.9
6.9	< Class 3	< 7.5

7.5	< Class 4	< 8.1
8.1	< Class 5	< 8.4
8.4	< Class 6	< 9.4
9.4	< Class 7	

v) Intersection with the country land area to get total area by wind classes in each country

vi) Re-projection to equal area projection to get the km2 of each wind class for each country

Steps in calculation of global wind potential:

b) Drop areas that are wind class < 3.0 (not feasible)

c) Assumption: technically feasible rotor density:
High: Assume technical feasibility at current wind rotor density (rotors/sq. km.) for Germany (which has the most installations: 17,574 as of 2005).
Low: 60% of Germany's current density

Source: German Wind Energy Institute, Statistics end of 2005
http://www.dewi.de/dewi_neu/englisch/index.html

d) Calculation of power production per standard wind rotor (POSR):

Source: Wind Energy Reference Manual, Danish Wind Industry Association
http://www.windpower.org/en/stat/unitsw.htm#anchor1345942

Wind power input: 0.5*1.225*(average wind speed per power class cubed)
[Watts/ m^2]
[The formula for the power per m^2 in Watts = 0.5 * 1.225 * v^3, where v is the wind speed in m/s.]
Adjustment for Weibull distribution of wind speed: Multiply by 2
[Watts/ m^2]
Expected power output: Multiply by 0.3
[Watts/ m^2]
Convert to yearly kWh: Multiply by (24 x 365.25/1000)
[kWh/ m^2/year]

e) Assumption: Standard 80m wind rotor swept area:
Multiply by 4656 m^2 [kWh/ m^2/year]

f) Calculate total power output:

Total power output (kWh/year) = POSR x technically feasible rotor density x feasible area

g) Adjustment for power losses (10%) = 0.90 x Total power output
[Due to wind turbine wakes, blade soiling, Operations & Management]

h) Convert to mtoe: Total adjusted power output x $8e^{-11}$

Offshore wind potential:

Most of the offshore wind locations are between 5 to15 meters in depth and a few kilometres to 15km from the shore. For each country we estimate the total area within its EEZ that is potentially suitable for offshore turbine installations.

Data Sources:

Wind speed at 80m elevation using same method as above for onshore; and
Two-minute gridded global relief for both ocean and land areas (combined bathymetry and topography) in the ETOPO2v2 (2006), NOAA:
http://www.ngdc.noaa.gov/mgg/global/global.html

EEZ: Exclusive economic zones: The Global Maritime Boundaries Database
http://www.maritimeBoundaries.com

Coastline: SRTM Water Body Dataset (SWBD)
http://edc.usgs.gov/products/elevation/swbd.html
Coastal delimitation based on the digital coastlines from the SRTM Water Body Dataset (shuttle radar topography mission), 90m resolution.
http://edcsns17.cr.usgs.gov/srtmbil/

a) Wind power calculation: same as steps b) through h) above.

6. Potential Solar Power

Data Source: NASA Surface Meteorology and Solar Energy: Global Data
Site URL: http://eosweb.larc.nasa.gov/sse/

a) Average Monthly Insolation (AMI):
Monthly Averaged Insolation Incident On A Horizontal Surface (kWh/m^2/day)
Monthly average for July 1983 - June 1993

b) Assumptions:
Low: Solar PV collectors cover 0.05% of total land area
High: Solar PV collectors cover 0.18% of total land area
High estimate is equivalent to the country area share assumed in estimates for Germany in: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2004), Ökologisch optimierter Ausbau der Nutzung erneuerbarer Energien in Deutschland, Berlin.
http://www.bmu.de/erneuerbare/energien/doc/5650.php (English summary available at this site)

c) Assumed conversion efficiency range (insolar => PV):
Low: 15%
High: 20%

Sources for conversion efficiency estimate:

- U.S. National Renewable Energy Laboratory. 2006. "High Performance Photovoltaic Project – Overview."

http://www.nrel.gov/highperformancepv/overview.html

- Green, M.A. 1998. "Photovoltaic Solar Energy Conversion: An Update." Australian Academy of Technological Sciences and Engineering, ATSE Focus No 102, May/June.
http://www.atse.org.au/index.php?sectionid=391

d) Annual Energy Generation (AEG - mtoe/year):

APG = 0.15 or 0.20 (conversion efficiency) x $8e^{-11}$ (mtoe/kWh) x AMI (kWh/m^2/day) x 365.25 (days/year) x .001 (% of land area) x land area (sq. km.) x 10^6 (m^2 / sq. km.)

7. Potential Hydro Power

Data Source: World Energy Council. 2001. Survey of Energy Resources – Hydro: Technically-Exploitable Capability (TEC - TWh/year)
http://www.worldenergy.org/wec-geis/publications/reports/ser/hydro/hydro.asp

a) Conversion to mtoe/year:

TEC (mtoe/year) = 0.08 (mtoe/TWh) x TEC (TWh/year)

8. CO_2 Storage Potential

Data Source: Hendriks, Chris, Graus, Wina, and Frank van Bergen. 2004. "Global Carbon Dioxide Storage Potential and Costs." Ecofys / Netherlands Institute of Applied Geoscience. EEP-02001. Table 20. CO2 storage potentials for the 18 world regions.

a) Initial Estimates, 18 World Regions: USA, Central America, South America, Northern Africa,Western Africa, Eastern Africa, Southern Africa, Western Europe, Eastern Europe, Former Soviet Union, Middle East, Southern Asia, Eastern Asia, South East. Asia, Oceania, Japan, Greenland

"Best Estimates" chosen from [Low, Best, High] for CO_2 capture potential in four classes: Oil fields, natural gas fields, coal fields, and saline aquifers (mostly offshore)

b) Country allocation of regional totals:

Country shares for natural gas, oil and coal fields calculated as:
Sum natural gas, oil and coal reserves by region from Sections 1-3 above
Compute country shares by region for natural gas, oil and coal
Apply country shares to "Best" estimated CO_2 capture potentials by region

c) Country shares for saline aquifer capture potential:
Sum extended economic zone (EEZ) areas by region
Compute country EEZ shares by region
Apply country shares to "Best" estimated CO_2 saline aquifer capture potentials by region.

d) Multiply country shares by "Best" regional totals to obtain country CO_2 capture potential for natural gas, oil and coal fields, and for saline aquifers. Sum to obtain total CO_2 capture potential (units: Gigatonnes)

e) Calculate storage as multiple of annual country CO_2 emissions:
Annual CO_2 Emissions (including land use) – thousand tonnes / year
Data Source: World Resources Institute – CAIT Database, 2006.

Ratio: Total CO2 capture potential (Gt) x 10^6 (kt/Gt) / Annual CO_2 emissions (kt)

9. Employment Vulnerability to a Global CO_2 Shadow Price Shock

a) Calculation of Sectoral Emissions Intensities:

i) Sectoral Emissions by IEA Industry Classification, 2002.
Data Source: International Energy Agency CO_2 Emissions Database

http://www.iea.org/Textbase/publications/index.asp

ii) GDP Breakdown by Sector, 2002.
Data Source: GDP and its breakdown at constant 1990 prices in US Dollars
UN National Accounts Main Aggregates Database at:
http://unstats.un.org/unsd/snaama/dnllist.asp

UN/IEA Sector Concordance: Developed by the authors

b) Calculation of Sectoral Employment Shares:

Data Source: ILO LABORSTA Online Database: Paid Employment by Economic Activity at: http://laborsta.ilo.org/, Yearly Data.

ILO/UN/IEA Sector Concordance: Developed by authors

Sector shares of paid employment computed by year
Utilized shares: Complete set (six composite sectors) only; most recent year.

c) Computation of Employment Vulnerability Index:

Weighted Combination of Sectoral CO_2 Emissions Intensities (2002; exception Estonia (1998))

Weights are sector employment shares from b)

10. Sequestration Potential via Reduced Deforestation

Data Source: World Resources Institute – CAIT Database, 2006
http://cait.wri.org/
CED: Annual CO_2 emissions attributable to deforestation and land clearing (ktonnes/yr)
CEG: Total annual CO2 emissions (ktonnes/yr).

a) Calculation of sequestration potential index: CED / CEG

11. Sea Level Impact

Data Source: DECRG Spatial Analysis Unit and computations from the project, "A Comparative Analysis of the Impacts of Sea-Level Rise in Developing Countries", 2007, Forthcoming Policy Research Working Paper, World Bank: Washington, DC.
SRTM :Shuttle Radar Topography Mission:
http://edcsns17.cr.usgs.gov/srtmbil/
Population: Center for International Earth Science Information Network (CIESIN), Columbia University; and Centro Internacional de Agricultura Tropical (CIAT). 2005. Gridded Population of the World Version 3 (GPWv3): Population Grids. Palisades, Columbia University.
http://sedac.ciesin.columbia.edu/gpw
GDP: http://www.worldbank.org/data/wdi2000
Agriculture: **PAGE Global Agricultural Extent version 2**, IFPRI
http://www.ifpri.org/data/PAGE01.htm

a) Impact index: Average % impacted for population, GDP and agriculture at 1- and 3-meter SLR.

b) Assumptions:

Sensitivity range: maximum 50km inland impact zone
Low: 1-meter impact
Intermediate: 2-meter impact
High: 3-meter impact

12. Climate-Induced Damage Index

Data source: EM-DAT: Emergency Disasters Database
CRED (Centre for Research on the Epidemiology of Disasters)
Université Catholique de Louvain, Brussels, Belgium
http://www.em-dat.net/

Indicators:
Deaths (D), population rendered homeless (H) and population affected (A)

For disasters in weather-related categories:
Drought, Extreme Temperature, Flood, Wild Fire and Wind Storm

Time period: 1960 – 2002

b) Assumption:
Weights placed on impacts: 1000 for deaths, 10 for homeless and 1 for "affected".

c) Calculation:
Damage Index = (1000*D + 10*H + A) / Population 1980 (midpoint population)

13. Biogas From Livestock Manure

a) Data on live animals:

Data source: FAOSTAT database, (2005): Cattle, buffalo, sheep, pigs, chickens, ducks

http://faostat.fao.org/faostat/form?collection=Production.Livestock.Stocks&Domain=Production&servlet=1&hasbulk=&version=ext&language=EN

b) Assumption: Manure generation by species, daily dry dung production

Source: Woods, J., and D.O. Hall. 1994. "Bioenergy for development - Technical and environmental dimensions." FAO, Environment and energy paper No. 13.

Dung production/animal/day:
Cattle 3 kg, buffalo 4 kg, sheep 0.5 kg, pigs 0.6 kg, chickens 0.1 kg, ducks 0.1 kg

c) Assumptions (from Woods and Hall):
50% of dung is potentially harvestable;
25% of potentially harvestable dung is recoverable;
Therefore, 12.5% (1/4 of ½) of total production is recoverable.

d) Conversion to energy (from Woods and Hall):
Vester Hjermitslev plant, Denmark, has a digester capacity of 1,500 m3 (approx. 50 tons manure per day) designed to produce 3,500 m3/day biogas.

e) Assumption: Energy content assumption for biogas: 24.4 MJ/m^3

Source: Wheeldon, Ian, Caners, Chris and Kunal Karan. 2005. "Anaerobic Digester Produced Biogas and Solid Oxide Fuel Cells: An Alternative Energy Source for Ontario Wastewater Treatment Facilities." Conference presentation, BIOCAP Canada.
http://www.biocap.ca/images/pdfs/conferencePosters/Wheeldon_I_P1.pdf

f) Calculation of Biogas energy potential, based on Vester Hjermitslev and BIOCAP Canada:

Biogasmtoe: 0.125 x (total dung (tonnes)/50) x 3500 (m^3/50 tons) x 24.4 (MJ/m^3) x $1.6e^{-10}$ (mtoe/MJ)

15. Land Ethanol Potential – Sugar Crops

Sources: Sugar crop yields: Table 2-2. Ethanol and Biodiesel Yield per Acre from Selected Crops, in Lester R. Brown, Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble (NY: W.W. Norton & Co., 2006). Table 2.2 compiled by Earth Policy Institute from the following sources: FAO, U.N. Food and Agriculture Organization (FAO), FAOSTAT Statistics Database, at apps.fao.org, updated 14 July 2005; Manitoba Department of Energy, Science, and Technology, "Ethanol FAQ," Energy Development Initiative Web site, www.gov.mb.ca/est/energy/ethanol/ ethanolfaq.html, viewed 5 August 2005; Renewable Fuels Association, Renewable Fuels Association, Homegrown Homeland for the Ethanol Industry Outlook 2005 (Washington, DC: 2005), pp. 2, 14–15; Nandini Nimbkar and Anil Rajvanshi, "Sweet Sorghum Ideal for Biofuel," Seed World, vol. 14, no. 8 (November 2003); Ellen I. Burnes et al., Ethanol in California: A Feasibility Framework (Modesto, CA: Great Valley Center, 2004), p. 18; Berg, op. cit. note 43; DOE, Biofuels from Switchgrass: Greener Energy Pastures (Oak Ridge, TN: Oak Ridge National Laboratory, 1998).

a) Sugar crops: Calculation of Ethanol Energy Potential (EEP – in Mtoe) per '000 hectares

Sugar Crop Yields in gallons of ethanol/acre (higher than any other rated farm crop (e.g. corn, cassava):

Sugar beet (France)	714
Sugar cane (Brazil)	662
Sweet Sorghum (India)	374

a.1) Conversion to gasoline equivalent (gal./acre): Multiply by 0.67 (Source: Brown, op. cit.)

a.2) Conversion to energy equivalent (MJ/acre): Multiply by 130.88 (MJ/gallon)
Energy in 1 gallon of gasoline: 130.88 MJ
Source: U.S. Department of Energy
http://www.eia.doe.gov/kids/energyfacts/science/energy_calculator.html#oilcalc

a.3) Conversion to MJ/hectare: Divide by 0.405 (1 acre = 0.405 hectares)

a.4) Conversion to Mtoe/hectare: Multiply by $1.6e^{-10}$ (Mtoe/MJ)

a.5) Conversion to Mtoe/1000 hectares: Multiply by 1000

Final calculation: EEP = Crop Yield x 0.67 x 130.88 / 0.405 x $1.6e^{-10}$ x 1000

b) Area suitable for cultivation of each sugar crop, by country:

Data Source: FAO – Global Agro-Ecological Zone Assessment
http://www.fao.org/AG/agl/agll/gaez/index.htm
Datasets: Suitability for 27 crops under rain-fed conditions

Mixed-input case employed: Determination of total suitable land (TSL) and total suitable land under forest ecosystems (TSLFE) as follows:

a) Determine all land very suitable and suitable at high level of inputs;
b) Of the balance of land after a), determine all land very suitable, suitable or moderately suitable at intermediate level of inputs, and
c) Of the balance of land after a) and b), determine all suitable land (i.e. "very suitable, suitable, moderately or marginally suitable land") at low level of inputs;
d) Of the balance of land after a), determine all land very suitable, suitable, moderately suitable or marginally suitable land in areas dominantly under forest ecosystems.

Suitable land for production (SLP) ('000 hectares):
[TSL] - [TSLFE]

c) Final calculation of ethanol energy potential from 10% suitable land for each sugar crop in each country:

Potential (Mtoe) = 0.10 x [Ethanol Energy Potential (/'000 hectares)] x SLP

16: Land Ethanol Potential – Switchgrass

a) Assumption: Ethanol Yield from Switchgrass (EYS): 2800 liters/hectare

Source: "Switchgrass : a living solar battery for the prairies"
http://www.eap.mcgill.ca/MagRack/SF/Fall%2091%20L.htm
Roger Samson
Ecological Agriculture Projects
McGill University (Macdonald Campus), Ste-Anne-de-Bellevue, Quebec

Yield in gallons per acre:

EYS / 3.79 (gallons/liter) / 0.405 (hectares/acre) x 0.67 (gasoline equivalent of ethanol) = 1222.19 (gallons/liter)

Convert to Mtoe/'000 hectares: (same as steps a.2) to a.5) above)

= 1222.19 / 0.405 x $1.6e^{-10}$ x 1000

b) Calculation of tallgrass savanna area (TSA - '000 hectares) in each country:

Data Source: WWF International: Terrestrial Ecoregions of the World
http://www.worldwildlife.org/science/data/terreco.cfm
Area data provided to DECRG in GIS format by WWF International
Agricultural land masked out.
Vegetation class used for tallgrass savanna: "Temperate Grasslands, Savannas and Shrublands"
Urban areas masked out based on GRUMP (see sources for *5.* above).

c) Final calculation of switchgrass ethanol potential production (Mtoe) on 10% of total savanna for each country:

Potential (Mtoe) = 0.10 x [Tallgrass savanna area ('000 hectares)] x [Ethanol Yield from Switchgrass (Mtoe/'000 hectares)]

17. Land Biodiesel Potential – Jatropha Curcas

a) Assumption: Biodiesel Yield from Jatropha: 2000 liters of biodiesel/hectare

Source: Worldwatch Institute, German Federal Ministry of Food, Agriculture and Consumer Protection. 2006. "Biofuels for Transportation: Global Potential and Implications for Sustainable Agriculture and Energy in the 21st Century." Washington, D.C., June 7.

b) Calculation of potential cultivation area (sq. km.) in each country:

Data Source: WWF International: Terrestrial Ecoregions of the World
http://www.worldwildlife.org/science/data/terreco.cfm
Area data provided to DECRG in GIS format by WWF International
Agricultural land masked out.
Vegetation classes used:
"Deserts and Xeric Shrublands" – Non-montane shrublands only
"Tropical-Subtropical Grasslands, Savannas and Shrublands"

Urban areas masked out based on GRUMP (see sources for *5.* above).

c) Assumption: Energy content of biodiesel: 34 MJ/liter
Source: Oak Ridge National Laboratory, Bioenergy Feedstock Development Programs
http://bioenergy.ornl.gov/papers/misc/energy_conv.html

d) Final calculation: Jatropha biodiesel potential (Mtoe) from 10% of potential cultivable land:

Potential (Mtoe) = 0.10 x [Potential area (sq km)] x 100 (hectares/sq km) x 2000 (liters/hectare) x 34 (MJ/liter) x $1.6e^{-10}$ (Mtoe/MJ)

Appendix 2: Country level estimates

Table A2.1: Non-Renewable Energy Resources and Annual Energy Consumption
(Millions of tons of oil equivalent)

Region	Subregion	Country	Coal	Oil	Gas	Oil Shale	Natural Bitumen	Annual Energy Consumption
AFR	Central Africa	Angola	0	1,219	0	0	0	8.8
AFR	Central Africa	Burundi	0	0	0	0	0	1.6
AFR	Central Africa	Cameroon	0	0	0	0	0	6.6
AFR	Central Africa	Central African Rep	0	0	0	0	0	1.7
AFR	Central Africa	Congo	0	252	0	0	0	0.9
AFR	Central Africa	Congo, Dem Rep	0	0	0	0	0	15.4
AFR	Central Africa	Gabon	0	302	0	0	0	1.6
AFR	Central Africa	Rwanda	0	0	0	0	0	3.4
AFR	Central Africa	Zambia	0	0	0	0	0	6.5
AFR	Coastal West Africa	Benin	0	0	0	0	0	2.2
AFR	Coastal West Africa	Cape Verde	0	0	0	0	0	0.7
AFR	Coastal West Africa	Côte d'Ivoire	0	0	0	0	0	6.6
AFR	Coastal West Africa	Equatorial Guinea	0	240	0	0	0	2.5
AFR	Coastal West Africa	Gambia	0	0	0	0	0	0.8
AFR	Coastal West Africa	Ghana	0	0	0	0	0	8.3
AFR	Coastal West Africa	Guinea	0	0	0	0	0	5.2
AFR	Coastal West Africa	Guinea-Bissau	0	0	0	0	0	0.4
AFR	Coastal West Africa	Liberia	0	0	0	0	0	
AFR	Coastal West Africa	Nigeria	0	4,842	4,702	0	0	95.7
AFR	Coastal West Africa	Sao Tome & Principe	0	0	0	0	0	
AFR	Coastal West Africa	Senegal	0	0	0	0	0	3.2
AFR	Coastal West Africa	Sierra Leone	0	0	0	0	0	0.8
AFR	Coastal West Africa	Togo	0	0	0	0	0	1.5
AFR	East Africa	Djibouti	0	0	0	0	0	0.7
AFR	East Africa	Eritrea	0	0	0	0	0	1.6
AFR	East Africa	Ethiopia	0	0	0	0	0	19.9
AFR	East Africa	Kenya	0	0	0	0	0	15.3
AFR	East Africa	Malawi	0	0	0	0	0	3.2
AFR	East Africa	Somalia	0	0	0	0	0	
AFR	East Africa	Sudan	0	864	0	0	0	15.9
AFR	East Africa	Tanzania	0	0	0	0	0	14.3
AFR	East Africa	Uganda	0	0	0	0	0	15.3
AFR	Indian Ocean Islands	Comoros	0	0	0	0	0	0.5
AFR	Indian Ocean Islands	Mauritius	0	0	0	0	0	6.0
AFR	Indian Ocean Islands	Seychelles	0	0	0	0	0	
AFR	Madagascar	Madagascar	0	0	0	0	0	6.6
AFR	Sahelian Africa	Burkina Faso	0	0	0	0	0	4.1
AFR	Sahelian Africa	Chad	0	129	0	0	0	2.4
AFR	Sahelian Africa	Mali	0	0	0	0	0	3.1
AFR	Sahelian Africa	Mauritania	0	0	0	0	0	1.6
AFR	Sahelian Africa	Niger	0	0	0	0	0	2.9

Region	Subregion	Country	Coal	Oil	Gas	Oil Shale	Natural Bitumen	Annual Energy Consumption
AFR	Southern Africa	Botswana	0	0	0	0	0	3.8
AFR	Southern Africa	Lesotho	0	0	0	0	0	1.1
AFR	Southern Africa	Mozambique	0	0	0	0	0	8.0
AFR	Southern Africa	Namibia	0	0	0	0	0	1.2
AFR	Southern Africa	South Africa	27,470	0	0	0	0	113.5
AFR	Southern Africa	Swaziland	0	0	0	0	0	1.4
AFR	Southern Africa	Zimbabwe	326	0	0	0	0	9.8
EAP	China	China	57,914	2,191	2,115	0	0	1,228.6
EAP	Northeast Asia	Korea, Rep	37	0	0	0	0	203.5
EAP	Northeast Asia	Mongolia	0	0	0	0	0	0.9
EAP	Pacific Islands	Fiji	0	0	0	0	0	0.9
EAP	Pacific Islands	Kiribati	0	0	0	0	0	
EAP	Pacific Islands	Marshall Islands	0	0	0	0	0	
EAP	Pacific Islands	Micronesia, Fed States	0	0	0	0	0	
EAP	Pacific Islands	Pacific Islands (Palau)	0	0	0	0	0	
EAP	Pacific Islands	Samoa	0	0	0	0	0	0.2
EAP	Pacific Islands	Solomon Islands	0	0	0	0	0	0.2
EAP	Pacific Islands	Timor-Leste				0	0	
EAP	Pacific Islands	Tonga	0	0	0	0	0	0.1
EAP	Pacific Islands	Vanuatu	0	0	0	0	0	0.1
EAP	Southeast Asia	Cambodia	0	0	0	0	0	5.2
EAP	Southeast Asia	Indonesia	3,055	595	2,484	0	0	156.1
EAP	Southeast Asia	Lao People's Dem Rep	0	0	0	0	0	1.9
EAP	Southeast Asia	Malaysia	0	537	2,236	0	0	51.8
EAP	Southeast Asia	Myanmar	0	0	450	0	0	12.6
EAP	Southeast Asia	Papua New Guinea	0	0	385	0	0	2.8
EAP	Southeast Asia	Philippines	0	0	0	0	0	42.0
EAP	Southeast Asia	Thailand	377	69	319	810	0	83.3
EAP	Southeast Asia	Viet Nam	84	426	208	0	0	42.6
ECA	Eastern Europe	Albania	0	0	0	5	0	1.9
ECA	Eastern Europe	Armenia	0	0	0	0	0	1.9
ECA	Eastern Europe	Belarus	0	0	0	0	0	24.8
ECA	Eastern Europe	Bosnia and Herzegovina	0	0	0	0	0	4.3
ECA	Eastern Europe	Bulgaria	367	0	0	0	0	19.0
ECA	Eastern Europe	Croatia	0	0	0	0	0	8.2
ECA	Eastern Europe	Czech Rep	2,104	0	0	0	0	41.7
ECA	Eastern Europe	Estonia	0	0	0	0	0	4.5
ECA	Eastern Europe	Georgia	0	0	0	0	0	2.6
ECA	Eastern Europe	Hungary	699	0	0	0	0	25.4
ECA	Eastern Europe	Latvia	0	0	0	0	0	4.3
ECA	Eastern Europe	Lithuania	0	0	0	0	0	8.6
ECA	Eastern Europe	Macedonia, FYR	0	0	0	0	0	4.3
ECA	Eastern Europe	Moldova, Rep	0	0	0	0	0	3.0
ECA	Eastern Europe	Poland	6,030	0	99	0	0	89.2
ECA	Eastern Europe	Romania	0	0	0	0	4	37.0
ECA	Eastern Europe	Russian Federation	72,182	10,478	43,038	0	0	617.8

Region	Subregion	Country	Coal	Oil	Gas	Oil Shale	Natural Bitumen	Annual Energy Consumption
ECA	Eastern Europe	Serbia and Montenegro	0	0	0	0	0	16.2
ECA	Eastern Europe	Slovakia	0	0	0	0	0	18.5
ECA	Eastern Europe	Slovenia	0	0	0	0	0	7.0
ECA	Eastern Europe	Ukraine	17,753	0	993	6,500	0	130.7
ECA	Middle East	Turkey	868	0	0	269	0	75.4
ECA	Western Asia	Azerbaijan	0	959	1,241	0	0	11.7
ECA	Western Asia	Kazakhstan	15,929	5,427	2,694	0	0	46.5
ECA	Western Asia	Kyrgyzstan	0	0	0	0	0	2.5
ECA	Western Asia	Tajikistan	0	0	0	0	0	3.2
ECA	Western Asia	Turkmenistan	0	75	2,609	0	0	16.6
ECA	Western Asia	Uzbekistan	0	81	1,664	0	0	51.7
LCR	Andean South America	Bolivia	0	0	669	0	0	4.3
LCR	Andean South America	Colombia	4,295	196	101	0	0	27.4
LCR	Andean South America	Ecuador	0	711	0	0	0	9.0
LCR	Andean South America	Peru	0	148	292	0	0	12.0
LCR	Caribbean Islands	Antigua and Barbuda	0	0	0	0	0	0.3
LCR	Caribbean Islands	Barbados	0	0	0	0	0	1.6
LCR	Caribbean Islands	Dominica	0	0	0	0	0	0.2
LCR	Caribbean Islands	Dominican Rep	0	0	0	0	0	8.2
LCR	Caribbean Islands	Grenada	0	0	0	0	0	0.3
LCR	Caribbean Islands	Haiti	0	0	0	0	0	2.1
LCR	Caribbean Islands	Jamaica	0	0	0	0	0	3.9
LCR	Caribbean Islands	Saint Kitts and Nevis	0	0	0	0	0	0.2
LCR	Caribbean Islands	St. Lucia	0	0	0	0	0	0.3
LCR	Caribbean Islands	St. Vincent & Grenadines	0	0	0	0	0	0.2
LCR	Caribbean Islands	Trinidad and Tobago	0	116	491	0	0	9.3
LCR	Central America	Belize	0	0	0	0	0	0.2
LCR	Central America	Costa Rica	0	0	0	0	0	3.6
LCR	Central America	El Salvador	0	0	0	0	0	4.3
LCR	Central America	Guatemala	0	0	0	0	0	7.4
LCR	Central America	Honduras	0	0	0	0	0	3.4
LCR	Central America	Mexico	581	1,733	371	0	0	157.3
LCR	Central America	Nicaragua	0	0	0	0	0	2.9
LCR	Central America	Panama	0	0	0	0	0	3.0
LCR	Northern South America	Brazil	3,903	1,693	277	9,646	0	190.7
LCR	Northern South America	Guyana	0	0	0	0	0	0.8
LCR	Northern South America	Suriname	0	0	0	0	0	
LCR	Northern South America	Venezuela	349	11,488	3,897	0	37,800	54.0
LCR	Southern South America	Argentina	0	317	455	0	0	56.3
LCR	Southern South America	Chile	0	0	0	0	0	24.7
LCR	Southern South America	Paraguay	0	0	0	0	0	3.9
LCR	Southern South America	Uruguay	0	0	0	0	0	2.5
MNA	Middle East	Iraq	0	15,520	2,859	0	0	29.0
MNA	Middle East	Jordan	0	0	0	24,000	40	5.4

Region	Subregion	Country	Coal	Oil	Gas	Oil Shale	Natural Bitumen	Annual Energy Consumption
MNA	Middle East	Lebanon	0	0	0	0	0	5.4
MNA	Middle East	Oman	0	756	898	0	0	10.8
MNA	Middle East	Syrian Arab Rep	0	389	281	0	0	18.1
MNA	Middle East	West Bank and Gaza	0	0	0	0	0	
MNA	Middle East	Yemen	0	374	432	0	0	4.1
MNA	North Africa	Algeria	0	1,589	4,121	0	0	30.8
MNA	North Africa	Egypt	0	538	1,705	0	0	52.4
MNA	North Africa	Libyan Arab Jamahiriya	0	5,095	1,338	0	0	18.7
MNA	North Africa	Morocco	0	0	0	5,900	0	10.8
MNA	North Africa	Tunisia	0	89	0	0	0	8.3
MNA	Western Asia	Iran, Islamic Rep	0	19,562	24,066	0	0	134.0
OTHER	Atlantic Islands	Channel Islands	0	0	0	0	0	
OTHER	Atlantic Islands	Faeroe Islands	0	0	0	0	0	
OTHER	Atlantic Islands	Greenland	0	0	0	0	0	
OTHER	Atlantic Islands	Iceland	0	0	0	0	0	3.4
OTHER	Atlantic Islands	Isle of Man	0	0	0	0	0	
OTHER	AustraliaNZ	Australia	43,023	515	2,269	36,985	0	112.7
OTHER	AustraliaNZ	New Zealand	351	0	0	0	0	18.0
OTHER	Caribbean Islands	Aruba	0	0	0	0	0	
OTHER	Caribbean Islands	Bahamas	0	0	0	0	0	2.0
OTHER	Caribbean Islands	Bermuda	0	0	0	0	0	
OTHER	Caribbean Islands	Cayman Islands	0	0	0	0	0	
OTHER	Caribbean Islands	Cuba	0	0	0	0	0	14.2
OTHER	Caribbean Islands	Netherlands Antilles	0	0	0	0	0	1.5
OTHER	Caribbean Islands	Puerto Rico	0	0	0	0	0	32.4
OTHER	Caribbean Islands	Virgin Islands	0	0	0	0	0	
OTHER	Indian Ocean Islands	Mayotte	0	0	0	0	0	
OTHER	Middle East	Bahrain	0	0	81	0	0	6.9
OTHER	Middle East	Israel	0	0	0	600	0	21.0
OTHER	Middle East	Kuwait	0	13,981	1,410	0	0	22.2
OTHER	Middle East	Qatar	0	1,996	23,234	0	0	12.2
OTHER	Middle East	Saudi Arabia	0	36,279	6,215	0	0	126.4
OTHER	Middle East	United Arab Emirates	0	12,954	5,426	0	0	36.1
OTHER	North America	Canada	3,465	2,314	1,426	0	45,300	250.0
OTHER	North America	United States	138,231	3,617	4,908	132,000	4,231	2,290.4
OTHER	Northeast Asia	Japan	196	0	0	0	0	516.9
OTHER	Northeast Asia	Korea, Dem People's Rep	0	0	0	0	0	19.5
OTHER	Northeast Asia	Taiwan	0	0	0	0	0	
OTHER	Pacific Islands	American Samoa	0	0	0	0	0	
OTHER	Pacific Islands	Cook Islands				0	0	
OTHER	Pacific Islands	French Polynesia	0	0	0	0	0	1.3
OTHER	Pacific Islands	Guam	0	0	0	0	0	
OTHER	Pacific Islands	Nauru	0	0	0	0	0	
OTHER	Pacific Islands	New Caledonia	0	0	0	0	0	1.1
OTHER	Pacific Islands	Niue				0	0	
OTHER	Pacific Islands	Northern Mariana Islands	0	0	0	0	0	

Region	Subregion	Country	Coal	Oil	Gas	Oil Shale	Natural Bitumen	Annual Energy Consumption
OTHER	Pacific Islands	Tuvalu	0	0	0	0	0	
OTHER	Southeast Asia	Brunei Darussalam	0	153	306	0	0	2.2
OTHER	Southeast Asia	Singapore	0	0	0	0	0	25.3
OTHER	Western Europe	Andorra	0	0	0	0	0	
OTHER	Western Europe	Austria	0	0	0	0	0	30.4
OTHER	Western Europe	Belgium	0	0	0	0	0	56.9
OTHER	Western Europe	Cyprus	0	0	0	0	0	2.5
OTHER	Western Europe	Denmark	0	164	61	0	0	19.7
OTHER	Western Europe	Finland	0	0	0	0	0	35.6
OTHER	Western Europe	France	5	0	0	0	0	265.9
OTHER	Western Europe	Germany	1,768	0	168	0	0	346.4
OTHER	Western Europe	Gibraltar	0	0	0	0	0	
OTHER	Western Europe	Greece	522	0	0	0	0	29.0
OTHER	Western Europe	Ireland	0	0	0	0	0	15.3
OTHER	Western Europe	Italy	0	98	151	0	0	172.7
OTHER	Western Europe	Liechtenstein	0	0	0	0	0	
OTHER	Western Europe	Luxembourg	0	0	0	0	0	4.0
OTHER	Western Europe	Malta	0	0	0	0	0	0.9
OTHER	Western Europe	Monaco	0	0	0	0	0	
OTHER	Western Europe	Netherlands	0	0	1,264	0	0	77.9
OTHER	Western Europe	Norway	0	1,298	2,165	0	0	26.5
OTHER	Western Europe	Portugal	0	0	0	0	0	26.4
OTHER	Western Europe	San Marino	0	0	0	0	0	
OTHER	Western Europe	Spain	174	0	0	0	0	131.6
OTHER	Western Europe	Sweden	0	0	0	0	0	51.0
OTHER	Western Europe	Switzerland	0	0	0	0	0	27.1
OTHER	Western Europe	United Kingdom	133	533	478	0	0	226.5
SAR	Indian Ocean Islands	Maldives	0	0	0	0	0	
SAR	Southern Asia	Bangladesh	0	0	393	0	0	21.0
SAR	Southern Asia	Bhutan	0	0	0	0	0	
SAR	Southern Asia	India	43,294	836	992	0	0	538.3
SAR	Southern Asia	Nepal	0	0	0	0	0	8.5
SAR	Southern Asia	Sri Lanka	0	0	0	0	0	8.2
SAR	Western Asia	Afghanistan	0	0	0	0	0	
SAR	Western Asia	Pakistan	1,394	0	866	0	0	65.8

Table A2.2a: Annual Energy From Renewable Resources: Solar, Onshore and Offshore Wind
(Millions of tons of oil equivalent)

Region	Subregion	Country	Solar			Onshore Wind			Offshore Wind		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
AFR	Central Africa	Angola	16.3	47.1	78.4	0.0	0.0	0.0	0.0	0.0	5.9
AFR	Central Africa	Burundi	0.3	0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Central Africa	Cameroon	6.0	17.4	29.0	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Central Africa	Central African Rep	8.2	23.6	39.4	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Central Africa	Congo	4.0	11.5	19.2	0.0	0.0	0.0	0.0	0.0	0.4
AFR	Central Africa	Congo, Dem Rep	28.3	81.6	135.9	0.0	0.0	0.0	0.0	0.0	0.3
AFR	Central Africa	Gabon	2.8	8.0	13.3	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Central Africa	Rwanda	0.3	0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Central Africa	Zambia	9.4	27.0	45.0	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Benin	1.5	4.3	7.2	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Cape Verde	0.1	0.2	0.3	0.3	0.5	0.6	0.0	0.0	0.0
AFR	Coastal West Africa	Côte d'Ivoire	4.1	11.8	19.6	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Equatorial Guinea	0.3	0.9	1.4	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Gambia	0.1	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Ghana	2.9	8.5	14.1	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Guinea	3.2	9.1	15.2	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Guinea-Bissau	0.4	1.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Liberia	1.2	3.4	5.6	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Nigeria	13.3	38.3	63.9	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Sao Tome & Principe	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Senegal	2.7	7.7	12.8	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Sierra Leone	0.9	2.6	4.3	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Togo	0.7	2.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0
AFR	East Africa	Djibouti	0.3	0.9	1.5	0.0	0.0	0.0	0.0	0.0	0.0
AFR	East Africa	Eritrea	1.5	4.3	7.1	0.0	0.0	0.0	0.0	0.0	0.0
AFR	East Africa	Ethiopia	14.0	40.2	67.0	0.3	0.5	0.6	0.0	0.0	0.0
AFR	East Africa	Kenya	8.0	23.1	38.6	2.7	3.7	4.6	0.0	0.0	0.2
AFR	East Africa	Malawi	1.2	3.4	5.7	0.0	0.0	0.0	0.0	0.0	0.0
AFR	East Africa	Somalia	9.6	27.7	46.2	32.4	43.2	54.0	0.1	0.3	0.6
AFR	East Africa	Sudan	34.8	100.2	167.0	10.7	14.3	17.9	0.0	0.0	0.0
AFR	East Africa	Tanzania	12.1	35.0	58.3	0.0	0.0	0.0	0.0	0.0	6.8
AFR	East Africa	Uganda	2.6	7.6	12.7	0.0	0.0	0.0	0.0	0.0	0.0

Region	Subregion	Country	Solar			Onshore Wind			Offshore Wind		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
AFR	Indian Ocean Islands	Comoros	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
AFR	Indian Ocean Islands	Mauritius	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.3
AFR	Indian Ocean Islands	Seychelles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
AFR	Madagascar	Madagascar	8.0	23.1	38.5	2.9	3.9	4.8	0.1	0.3	20.5
AFR	Sahelian Africa	Burkina Faso	3.9	11.3	18.9	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Sahelian Africa	Chad	18.6	53.6	89.4	0.6	0.9	1.1	0.0	0.0	0.0
AFR	Sahelian Africa	Mali	17.8	51.4	85.6	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Sahelian Africa	Mauritania	14.2	41.0	68.3	4.4	5.9	7.4	0.0	0.3	0.6
AFR	Sahelian Africa	Niger	19.0	54.6	91.0	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Southern Africa	Botswana	7.2	20.6	34.3	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Southern Africa	Lesotho	0.3	1.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Southern Africa	Mozambique	10.6	30.5	50.9	0.0	0.0	0.0	0.0	0.0	14.2
AFR	Southern Africa	Namibia	11.2	32.3	53.9	0.0	0.0	0.0	0.0	0.0	1.2
AFR	Southern Africa	South Africa	15.8	45.5	75.9	0.1	0.1	0.1	0.0	0.0	1.9
AFR	Southern Africa	Swaziland	0.2	0.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0
AFR	Southern Africa	Zimbabwe	4.8	13.8	23.0	0.0	0.0	0.0	0.0	0.0	0.0
EAP	China	China	109.0	313.8	523.0	228.6	304.9	381.1	0.1	0.6	23.1
EAP	Northeast Asia	Korea, Rep	0.9	2.7	4.5	0.0	0.0	0.0	0.0	0.0	0.1
EAP	Northeast Asia	Mongolia	15.5	44.7	74.5	5.9	7.9	9.9	0.0	0.0	0.0
EAP	Pacific Islands	Fiji	0.2	0.7	1.1	0.0	0.0	0.0	0.0	0.0	3.8
EAP	Pacific Islands	Kiribati	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
EAP	Pacific Islands	Marshall Islands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
EAP	Pacific Islands	Micronesia, Fed States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Pacific Islands (Palau)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
EAP	Pacific Islands	Samoa	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Solomon Islands	0.3	1.0	1.6	0.0	0.0	0.0	0.0	0.0	5.8
EAP	Pacific Islands	Timor-Leste	0.2	0.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Tonga	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Vanuatu	0.1	0.4	0.7	0.0	0.0	0.0	0.0	0.0	1.0
EAP	Southeast Asia	Cambodia	2.1	5.9	9.9	0.0	0.0	0.0	0.0	0.0	3.4
EAP	Southeast Asia	Indonesia	26.2	75.6	126.0	0.0	0.0	0.0	0.0	0.0	134.7
EAP	Southeast Asia	Lao People's Dem Rep	2.6	7.6	12.6	0.0	0.0	0.0	0.0	0.0	0.0
EAP	Southeast Asia	Malaysia	4.1	11.9	19.8	0.0	0.0	0.0	0.0	0.0	36.2
EAP	Southeast Asia	Myanmar	7.8	22.4	37.4	0.0	0.0	0.0	0.0	0.0	18.8
EAP	Southeast Asia	Papua New Guinea	5.7	16.5	27.6	0.0	0.0	0.0	0.0	0.0	21.8

Region	Subregion	Country	Solar			Onshore Wind			Offshore Wind		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
EAP	Southeast Asia	Philippines	3.9	11.2	18.6	0.5	0.7	0.9	0.0	0.0	49.0
EAP	Southeast Asia	Thailand	6.2	17.8	29.7	0.0	0.0	0.0	0.0	0.0	24.6
EAP	Southeast Asia	Viet Nam	3.8	11.1	18.4	0.6	0.7	0.9	0.0	0.1	21.1
ECA	Eastern Europe	Albania	0.3	0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Armenia	0.2	0.7	1.2	0.7	1.0	1.2	0.0	0.0	0.0
ECA	Eastern Europe	Belarus	1.3	3.9	6.4	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Bosnia and Herzegovina	0.4	1.2	2.0	0.3	0.3	0.4	0.0	0.0	0.0
ECA	Eastern Europe	Bulgaria	1.0	2.9	4.8	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Croatia	0.5	1.4	2.4	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Czech Rep	0.5	1.4	2.4	2.3	3.0	3.8	0.0	0.0	0.0
ECA	Eastern Europe	Estonia	0.3	0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Georgia	0.6	1.7	2.8	2.7	3.6	4.5	0.0	0.0	0.0
ECA	Eastern Europe	Hungary	0.7	2.0	3.4	0.0	0.0	0.1	0.0	0.0	0.0
ECA	Eastern Europe	Latvia	0.4	1.2	2.0	0.1	0.2	0.2	0.0	0.0	0.0
ECA	Eastern Europe	Lithuania	0.4	1.2	2.0	0.2	0.2	0.3	0.0	0.0	0.0
ECA	Eastern Europe	Macedonia, FYR	0.2	0.6	1.1	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Moldova, Rep	0.2	0.7	1.2	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Poland	2.2	6.3	10.4	0.4	0.5	0.6	0.0	0.0	0.1
ECA	Eastern Europe	Romania	1.9	5.6	9.3	0.1	0.1	0.2	0.0	0.0	0.0
ECA	Eastern Europe	Russian Federation	146.9	423.2	705.3	55.7	74.3	92.9	0.6	1.7	6.3
ECA	Eastern Europe	Serbia and Montenegro	0.8	2.4	4.0	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Slovakia	0.3	1.0	1.6	0.7	0.9	1.1	0.0	0.0	0.0
ECA	Eastern Europe	Slovenia	0.1	0.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Eastern Europe	Ukraine	4.9	14.0	23.3	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Middle East	Turkey	8.6	24.6	41.0	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Western Asia	Azerbaijan	0.8	2.2	3.6	6.2	8.3	10.4	0.0	0.0	0.0
ECA	Western Asia	Kazakhstan	25.7	74.0	123.3	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Western Asia	Kyrgyzstan	1.8	5.2	8.6	3.5	4.7	5.9	0.0	0.0	0.0
ECA	Western Asia	Tajikistan	1.4	4.1	6.8	5.9	7.8	9.8	0.0	0.0	0.0
ECA	Western Asia	Turkmenistan	4.9	14.1	23.5	0.0	0.0	0.0	0.0	0.0	0.0
ECA	Western Asia	Uzbekistan	4.2	12.2	20.3	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Andean South America	Bolivia	13.9	40.1	66.8	25.4	33.9	42.3	0.0	0.0	0.0
LCR	Andean South America	Colombia	14.8	42.5	70.9	1.8	2.5	3.1	0.1	0.3	0.6
LCR	Andean South America	Ecuador	3.9	11.2	18.7	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Andean South America	Peru	17.1	49.1	81.9	0.0	0.0	0.0	0.0	0.0	0.0

Region	Subregion	Country	Solar			Onshore Wind			Offshore Wind		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
LCR	Caribbean Islands	Antigua and Barbuda	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1
LCR	Caribbean Islands	Barbados	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Dominica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Dominican Rep	0.6	1.9	3.1	0.3	0.4	0.5	0.0	0.0	0.0
LCR	Caribbean Islands	Grenada	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Haiti	0.4	1.1	1.8	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Jamaica	0.1	0.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Saint Kitts and Nevis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	St. Lucia	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
LCR	Caribbean Islands	St. Vincent & Grenadines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Trinidad and Tobago	0.1	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Central America	Belize	0.3	0.8	1.4	0.0	0.0	0.1	0.0	0.0	0.0
LCR	Central America	Costa Rica	0.7	1.9	3.2	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Central America	El Salvador	0.3	0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Central America	Guatemala	1.4	3.9	6.6	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Central America	Honduras	1.4	4.1	6.9	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Central America	Mexico	26.1	75.2	125.3	1.4	1.9	2.4	0.0	0.1	0.1
LCR	Central America	Nicaragua	1.5	4.4	7.3	0.5	0.7	0.9	0.1	0.5	1.0
LCR	Central America	Panama	0.9	2.5	4.2	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Northern South America	Brazil	118.3	340.6	567.7	6.4	8.6	10.7	0.0	0.2	29.0
LCR	Northern South America	Guyana	2.5	7.3	12.2	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Northern South America	Suriname	2.1	5.9	9.9	0.0	0.0	0.0	0.0	0.0	0.0
LCR	Northern South America	Venezuela	12.5	36.0	59.9	2.2	3.0	3.7	0.3	0.9	1.8
LCR	Southern South America	Argentina	35.5	102.3	170.4	93.1	124.2	155.2	2.3	5.2	23.1
LCR	Southern South America	Chile	9.7	28.1	46.8	46.0	61.3	76.6	2.7	8.4	11.0
LCR	Southern South America	Paraguay	4.2	12.2	20.3	7.5	10.0	12.5	0.0	0.0	0.0
LCR	Southern South America	Uruguay	1.8	5.1	8.5	0.1	0.1	0.1	0.0	0.0	3.1
MNA	Middle East	Iraq	5.3	15.2	25.3	0.0	0.0	0.0	0.0	0.0	0.0
MNA	Middle East	Jordan	1.1	3.2	5.3	0.0	0.0	0.0	0.0	0.0	0.0
MNA	Middle East	Lebanon	0.1	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0
MNA	Middle East	Oman	4.3	12.5	20.8	0.6	0.8	0.9	0.0	0.1	0.1
MNA	Middle East	Syrian Arab Rep	2.1	6.1	10.2	0.0	0.0	0.0	0.0	0.0	0.0
MNA	Middle East	West Bank and Gaza	0.1	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
MNA	Middle East	Yemen	8.0	22.9	38.2	1.6	2.1	2.7	0.0	0.0	0.1
MNA	North Africa	Algeria	34.7	100.0	166.6	0.0	0.0	0.0	0.0	0.0	0.0

Region	Subregion	Country	Solar			Onshore Wind			Offshore Wind		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
MNA	North Africa	Egypt	14.6	42.0	69.9	3.4	4.5	5.7	0.0	0.0	0.0
MNA	North Africa	Libyan Arab Jamahiriya	24.8	71.4	119.0	5.0	6.7	8.4	0.0	0.0	0.0
MNA	North Africa	Morocco	5.6	16.0	26.7	0.3	0.3	0.4	0.0	0.0	0.0
MNA	North Africa	Tunisia	2.0	5.8	9.7	0.3	0.4	0.5	0.0	0.0	0.0
MNA	Western Asia	Iran, Islamic Rep	20.2	58.0	96.7	12.9	17.3	21.6	0.0	0.0	0.0
OTHER	Atlantic Islands	Channel Islands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Atlantic Islands	Faeroe Islands	0.0	0.0	0.0	0.3	0.4	0.5	0.0	0.0	0.0
OTHER	Atlantic Islands	Greenland	2.7	7.8	13.0	57.4	76.5	95.7	0.0	0.1	0.1
OTHER	Atlantic Islands	Iceland	0.5	1.5	2.4	17.8	23.7	29.7	0.0	0.0	0.0
OTHER	Atlantic Islands	Isle of Man	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
OTHER	AustraliaNZ	Australia	112.8	324.9	541.4	52.5	70.0	87.5	2.0	6.2	135.3
OTHER	AustraliaNZ	New Zealand	2.9	8.3	13.8	22.5	30.0	37.4	0.9	2.0	9.7
OTHER	Caribbean Islands	Aruba	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1
OTHER	Caribbean Islands	Bahamas	0.1	0.4	0.6	0.1	0.1	0.1	0.1	0.1	0.2
OTHER	Caribbean Islands	Bermuda				0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Cayman Islands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Cuba	1.4	4.1	6.9	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Netherlands Antilles	0.0	0.0	0.1	0.2	0.2	0.3	0.1	0.1	0.1
OTHER	Caribbean Islands	Puerto Rico	0.1	0.3	0.6	0.1	0.1	0.1	0.0	0.1	0.2
OTHER	Caribbean Islands	Virgin Islands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
OTHER	Indian Ocean Islands	Mayotte	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
OTHER	Middle East	Bahrain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Middle East	Israel	0.3	0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Middle East	Kuwait	0.2	0.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Middle East	Qatar	0.1	0.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Middle East	Saudi Arabia	30.5	87.8	146.3	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Middle East	United Arab Emirates	1.1	3.3	5.5	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	North America	Canada	73.8	212.4	354.0	87.3	116.3	145.4	4.7	13.1	24.6
OTHER	North America	United States	118.2	340.5	567.5	111.8	149.0	186.3	2.6	8.3	17.1
OTHER	Northeast Asia	Japan	3.7	10.6	17.7	2.6	3.5	4.4	0.1	0.2	17.0
OTHER	Northeast Asia	Korea, DPR	1.1	3.1	5.2	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Northeast Asia	Taiwan	0.4	1.1	1.8	0.7	1.0	1.2	0.1	0.1	2.4
OTHER	Pacific Islands	American Samoa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Cook Islands				0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	French Polynesia	0.1	0.2	0.3	0.0	0.1	0.1	0.0	0.0	0.0

Region	Subregion	Country	Solar			Onshore Wind			Offshore Wind		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
OTHER	Pacific Islands	Guam	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Nauru				0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	New Caledonia	0.2	0.7	1.1	0.0	0.0	0.0	0.0	0.0	0.4
OTHER	Pacific Islands	Niue				0.0	0.0	0.1	0.0	0.0	0.0
OTHER	Pacific Islands	Northern Mariana Islands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Tuvalu				0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Southeast Asia	Brunei Darussalam	0.1	0.2	0.3	0.0	0.0	0.0	0.0	0.0	1.7
OTHER	Southeast Asia	Singapore	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
OTHER	Western Europe	Andorra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Austria	0.6	1.7	2.9	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Belgium	0.2	0.6	1.0	0.0	0.0	0.0	0.1	0.3	0.5
OTHER	Western Europe	Cyprus	0.1	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Denmark	0.3	0.8	1.4	5.5	7.4	9.2	1.0	3.8	7.5
OTHER	Western Europe	Finland	1.9	5.5	9.2	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	France	5.4	15.6	25.9	8.0	10.7	13.3	0.2	0.7	1.9
OTHER	Western Europe	Germany	2.5	7.1	11.8	3.8	5.1	6.4	0.1	0.5	1.2
OTHER	Western Europe	Gibraltar				0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Greece	1.6	4.5	7.4	0.2	0.3	0.4	0.1	0.3	0.4
OTHER	Western Europe	Ireland	0.4	1.3	2.1	9.1	12.1	15.1	0.4	1.0	2.0
OTHER	Western Europe	Italy	3.2	9.3	15.6	0.6	0.7	0.9	0.0	0.0	0.1
OTHER	Western Europe	Liechtenstein	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Luxembourg	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Monaco				0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Netherlands	0.2	0.7	1.2	2.0	2.7	3.3	0.6	1.9	3.7
OTHER	Western Europe	Norway	1.9	5.4	8.9	5.1	6.7	8.4	0.0	0.1	0.2
OTHER	Western Europe	Portugal	1.0	2.9	4.8	0.1	0.1	0.1	0.0	0.0	0.0
OTHER	Western Europe	San Marino	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER	Western Europe	Spain	6.3	18.3	30.4	2.5	3.3	4.2	0.1	0.1	0.3
OTHER	Western Europe	Sweden	2.8	8.0	13.4	0.6	0.8	1.0	0.0	0.1	0.4
OTHER	Western Europe	Switzerland	0.3	0.8	1.4	0.1	0.1	0.2	0.0	0.0	0.0
OTHER	Western Europe	United Kingdom	1.7	4.9	8.1	13.8	18.4	23.0	0.9	2.3	5.0
SAR	Indian Ocean Islands	Maldives				0.0	0.0	0.0	0.0	0.0	0.1
SAR	Southern Asia	Bangladesh	1.4	4.1	6.9	0.0	0.0	0.0	0.0	0.0	4.9
SAR	Southern Asia	Bhutan	0.5	1.5	2.6	0.2	0.3	0.4	0.0	0.0	0.0

Region	Subregion	Country	Solar			Onshore Wind			Offshore Wind		
			Low	Medium	High	Low	Medium	High	Low	Medium	High
SAR	Southern Asia	India	36.9	106.4	177.3	17.8	23.8	29.7	0.0	0.0	44.0
SAR	Southern Asia	Nepal	1.7	4.8	8.0	0.0	0.0	0.1	0.0	0.0	0.0
SAR	Southern Asia	Sri Lanka	0.8	2.3	3.9	0.5	0.6	0.8	0.0	0.1	6.4
SAR	Western Asia	Afghanistan	7.9	22.8	37.9	32.3	43.0	53.8	0.0	0.0	0.0
SAR	Western Asia	Pakistan	9.4	27.1	45.1	15.7	20.9	26.2	0.0	0.0	1.1

Table A2.2b: Annual Energy From Renewable Resources: Hydro and Geothermal
(Millions of tons of oil equivalent)

Region	Subregion	Country	Hydro	Geothermal		
				Low	Medium	High
AFR	Central Africa	Angola	7.2	0.0	0.0	0.0
AFR	Central Africa	Burundi	0.1	0.0	0.0	0.0
AFR	Central Africa	Cameroon	9.2	0.0	0.0	0.0
AFR	Central Africa	Central African Rep	0.2	0.0	0.0	0.0
AFR	Central Africa	Congo	4.0	0.0	0.0	0.0
AFR	Central Africa	Congo, Dem Rep	61.9	0.6	1.2	1.8
AFR	Central Africa	Gabon	6.4	0.0	0.0	0.0
AFR	Central Africa	Rwanda	0.0	0.0	0.0	0.0
AFR	Central Africa	Zambia	2.3	0.1	0.3	0.4
AFR	Coastal West Africa	Benin	0.1	0.0	0.0	0.0
AFR	Coastal West Africa	Cape Verde	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Côte d'Ivoire	1.0	0.0	0.0	0.0
AFR	Coastal West Africa	Equatorial Guinea	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Gambia	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Ghana	0.9	0.0	0.0	0.0
AFR	Coastal West Africa	Guinea	1.5	0.0	0.0	0.0
AFR	Coastal West Africa	Guinea-Bissau	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Liberia	0.9	0.0	0.0	0.0
AFR	Coastal West Africa	Nigeria	2.6	0.0	0.1	0.1
AFR	Coastal West Africa	Sao Tome & Principe	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Senegal	0.3	0.0	0.0	0.0
AFR	Coastal West Africa	Sierra Leone	0.6	0.0	0.0	0.0
AFR	Coastal West Africa	Togo	0.2	0.0	0.0	0.0
AFR	East Africa	Djibouti	0.0	0.0	0.0	0.0
AFR	East Africa	Eritrea	0.0	0.0	0.0	0.0
AFR	East Africa	Ethiopia	20.8	0.0	0.0	0.0
AFR	East Africa	Kenya	0.7	0.4	0.8	1.3
AFR	East Africa	Malawi	0.5	0.0	0.0	0.0
AFR	East Africa	Somalia	0.1	0.1	0.1	0.2
AFR	East Africa	Sudan	1.5	0.2	0.3	0.5
AFR	East Africa	Tanzania	1.6	0.2	0.4	0.6
AFR	East Africa	Uganda	0.6	0.0	0.0	0.0
AFR	Indian Ocean Islands	Comoros	0.0	0.0	0.0	0.0
AFR	Indian Ocean Islands	Mauritius	0.0	0.0	0.0	0.0
AFR	Indian Ocean Islands	Seychelles	0.0	0.0	0.0	0.0
AFR	Madagascar	Madagascar	14.4	0.0	0.0	0.0
AFR	Sahelian Africa	Burkina Faso	0.0	0.0	0.0	0.0
AFR	Sahelian Africa	Chad	0.0	0.0	0.0	0.0
AFR	Sahelian Africa	Mali	0.4	0.0	0.0	0.0
AFR	Sahelian Africa	Mauritania	0.0	0.0	0.0	0.0
AFR	Sahelian Africa	Niger	0.1	0.0	0.0	0.0
AFR	Southern Africa	Botswana	0.0	0.2	0.3	0.5
AFR	Southern Africa	Lesotho	0.2	0.0	0.0	0.0
AFR	Southern Africa	Mozambique	3.0	0.0	0.0	0.0
AFR	Southern Africa	Namibia	0.7	0.2	0.4	0.6

Region	Subregion	Country	Hydro	Geothermal		
				Low	Medium	High
AFR	Southern Africa	South Africa	0.9	0.1	0.2	0.3
AFR	Southern Africa	Swaziland	0.1	0.0	0.0	0.0
AFR	Southern Africa	Zimbabwe	1.4	0.0	0.1	0.1
EAP	China	China	153.6	4.7	10.2	16.6
EAP	Northeast Asia	Korea, Rep	2.1	0.1	0.2	0.4
EAP	Northeast Asia	Mongolia	1.8	1.0	2.0	3.0
EAP	Pacific Islands	Fiji	0.1	0.0	0.0	0.0
EAP	Pacific Islands	Kiribati	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Marshall Islands	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Micronesia, Fed States	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Pacific Islands (Palau)	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Samoa	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Solomon Islands	0.1	0.0	0.0	0.0
EAP	Pacific Islands	Timor-Leste	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Tonga	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Vanuatu	0.0	0.0	0.0	0.0
EAP	Southeast Asia	Cambodia	6.6	0.0	0.0	0.0
EAP	Southeast Asia	Indonesia	32.2	4.5	9.9	16.1
EAP	Southeast Asia	Lao People's Dem Rep	5.0	0.0	0.0	0.0
EAP	Southeast Asia	Malaysia	9.8	0.1	0.2	0.3
EAP	Southeast Asia	Myanmar	10.4	0.0	0.0	0.0
EAP	Southeast Asia	Papua New Guinea	9.8	0.0	0.0	0.1
EAP	Southeast Asia	Philippines	1.6	0.1	0.2	0.3
EAP	Southeast Asia	Thailand	1.5	1.6	3.1	4.7
EAP	Southeast Asia	Viet Nam	8.0	0.0	0.0	0.0
ECA	Eastern Europe	Albania	1.2	0.0	0.0	0.0
ECA	Eastern Europe	Armenia	0.6	0.0	0.1	0.2
ECA	Eastern Europe	Belarus	0.2	0.0	0.0	0.1
ECA	Eastern Europe	Bosnia and Herzegovina	1.9	0.0	0.0	0.0
ECA	Eastern Europe	Bulgaria	1.2	0.1	0.3	0.5
ECA	Eastern Europe	Croatia	0.7	0.0	0.0	0.0
ECA	Eastern Europe	Czech Rep	0.3	0.0	0.1	0.1
ECA	Eastern Europe	Estonia	0.0	0.1	0.2	0.2
ECA	Eastern Europe	Georgia	5.4	0.0	0.0	0.0
ECA	Eastern Europe	Hungary	0.4	0.1	0.3	0.5
ECA	Eastern Europe	Latvia	0.5	0.1	0.2	0.3
ECA	Eastern Europe	Lithuania	0.2	0.1	0.1	0.2
ECA	Eastern Europe	Macedonia, FYR	0.5	0.0	0.0	0.0
ECA	Eastern Europe	Moldova, Rep	0.1	0.1	0.1	0.2
ECA	Eastern Europe	Poland	1.1	0.1	0.3	0.5
ECA	Eastern Europe	Romania	2.9	0.0	0.0	0.0
ECA	Eastern Europe	Russian Federation	133.6	26.2	57.1	92.8
ECA	Eastern Europe	Serbia and Montenegro	2.2	0.0	0.0	0.0
ECA	Eastern Europe	Slovakia	0.6	0.1	0.2	0.3
ECA	Eastern Europe	Slovenia	0.7	0.0	0.0	0.0
ECA	Eastern Europe	Ukraine	1.9	0.5	1.0	1.6
ECA	Middle East	Turkey	17.3	0.0	0.0	0.0
ECA	Western Asia	Azerbaijan	1.3	0.2	0.4	0.6

Region	Subregion	Country	Hydro	Geothermal		
				Low	Medium	High
ECA	Western Asia	Kazakhstan	5.0	0.6	1.2	1.8
ECA	Western Asia	Kyrgyzstan	7.9	0.4	0.8	1.3
ECA	Western Asia	Tajikistan	21.1	0.4	0.8	1.2
ECA	Western Asia	Turkmenistan	0.4	1.1	2.3	3.4
ECA	Western Asia	Uzbekistan	2.2	0.9	1.9	2.8
LCR	Andean South America	Bolivia	10.1	1.4	2.8	4.2
LCR	Andean South America	Colombia	16.0	0.0	0.0	0.0
LCR	Andean South America	Ecuador	2.6	0.0	0.1	0.1
LCR	Andean South America	Peru	20.8	0.9	1.9	3.0
LCR	Caribbean Islands	Antigua and Barbuda	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Barbados	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Dominica	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Dominican Rep	0.7	0.0	0.0	0.0
LCR	Caribbean Islands	Grenada	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Haiti	0.1	0.0	0.0	0.0
LCR	Caribbean Islands	Jamaica	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Saint Kitts and Nevis	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	St. Lucia	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	St. Vincent & Grenadines	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Trinidad and Tobago	0.0	0.0	0.0	0.0
LCR	Central America	Belize	0.0	0.0	0.0	0.0
LCR	Central America	Costa Rica	3.4	0.0	0.0	0.0
LCR	Central America	El Salvador	0.4	0.0	0.0	0.0
LCR	Central America	Guatemala	1.8	0.0	0.0	0.0
LCR	Central America	Honduras	0.5	0.0	0.0	0.0
LCR	Central America	Mexico	5.1	1.0	2.1	3.4
LCR	Central America	Nicaragua	0.8	0.0	0.0	0.0
LCR	Central America	Panama	1.0	0.0	0.0	0.0
LCR	Northern South America	Brazil	119.0	0.1	0.3	0.5
LCR	Northern South America	Guyana	2.0	0.0	0.0	0.0
LCR	Northern South America	Suriname	1.0	0.0	0.0	0.0
LCR	Northern South America	Venezuela	20.9	0.0	0.0	0.0
LCR	Southern South America	Argentina	10.4	0.0	0.0	0.0
LCR	Southern South America	Chile	13.0	0.1	0.3	0.4
LCR	Southern South America	Paraguay	6.8	0.0	0.0	0.0
LCR	Southern South America	Uruguay	0.8	0.0	0.0	0.0
MNA	Middle East	Iraq	7.2	0.0	0.0	0.0
MNA	Middle East	Jordan	0.0	0.0	0.0	0.1
MNA	Middle East	Lebanon	0.1	0.0	0.0	0.0
MNA	Middle East	Oman	0.0	0.0	0.0	0.0
MNA	Middle East	Syrian Arab Rep	0.3	0.0	0.0	0.0
MNA	Middle East	West Bank and Gaza	0.0	0.0	0.0	0.0
MNA	Middle East	Yemen	0.0	0.0	0.0	0.0
MNA	North Africa	Algeria	0.4	0.0	0.0	0.0
MNA	North Africa	Egypt	4.0	0.4	1.0	1.5
MNA	North Africa	Libyan Arab Jamahiriya	0.0	0.0	0.0	0.0
MNA	North Africa	Morocco	0.4	1.4	2.7	4.1
MNA	North Africa	Tunisia	0.0	0.0	0.0	0.0

Region	Subregion	Country	Hydro	Geothermal		
				Low	Medium	High
MNA	Western Asia	Iran, Islamic Rep	7.0	0.1	0.1	0.2
OTHER	Atlantic Islands	Channel Islands	0.0	0.0	0.0	0.0
OTHER	Atlantic Islands	Faeroe Islands	0.0	0.0	0.0	0.0
OTHER	Atlantic Islands	Greenland	1.1	0.0	0.0	0.0
OTHER	Atlantic Islands	Iceland	5.1	0.2	0.4	0.6
OTHER	Atlantic Islands	Isle of Man	0.0	0.0	0.0	0.0
OTHER	AustraliaNZ	Australia	2.4	0.5	1.1	1.7
OTHER	AustraliaNZ	New Zealand	6.2	0.6	1.4	2.2
OTHER	Caribbean Islands	Aruba	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Bahamas	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Bermuda	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Cayman Islands	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Cuba	0.2	0.2	0.3	0.5
OTHER	Caribbean Islands	Netherlands Antilles	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Puerto Rico	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Virgin Islands	0.0	0.0	0.0	0.0
OTHER	Indian Ocean Islands	Mayotte	0.0	0.0	0.0	0.0
OTHER	Middle East	Bahrain	0.0	0.0	0.0	0.0
OTHER	Middle East	Israel	2.8	0.0	0.1	0.1
OTHER	Middle East	Kuwait	0.0	0.0	0.0	0.0
OTHER	Middle East	Qatar	0.0	0.0	0.0	0.0
OTHER	Middle East	Saudi Arabia	0.0	0.1	0.2	0.3
OTHER	Middle East	United Arab Emirates	0.0	0.0	0.0	0.0
OTHER	North America	Canada	76.1	1.1	2.4	3.9
OTHER	North America	United States	42.3	3.9	8.6	13.9
OTHER	Northeast Asia	Japan	10.9	0.6	1.4	2.3
OTHER	Northeast Asia	Korea, Dem People's Rep	0.0	0.0	0.0	0.0
OTHER	Northeast Asia	Taiwan	1.1	0.0	0.0	0.0
OTHER	Pacific Islands	American Samoa	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Cook Islands		0.0	0.0	0.0
OTHER	Pacific Islands	French Polynesia	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Guam	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Nauru	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	New Caledonia	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Niue	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Northern Mariana Islands	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Tuvalu	0.0	0.0	0.0	0.0
OTHER	Southeast Asia	Brunei Darussalam	0.0	0.0	0.0	0.0
OTHER	Southeast Asia	Singapore	0.0	0.0	0.0	0.0
OTHER	Western Europe	Andorra	0.0	0.0	0.0	0.0
OTHER	Western Europe	Austria	4.5	0.0	0.1	0.1
OTHER	Western Europe	Belgium	0.0	0.0	0.0	0.0
OTHER	Western Europe	Cyprus	1.9	0.0	0.0	0.0
OTHER	Western Europe	Denmark	0.0	0.0	0.1	0.2
OTHER	Western Europe	Finland	1.6	0.0	0.0	0.0
OTHER	Western Europe	France	5.8	1.1	2.3	3.7
OTHER	Western Europe	Germany	2.1	0.2	0.4	0.7
OTHER	Western Europe	Gibraltar	0.0	0.0	0.0	0.0

Region	Subregion	Country	Hydro	Geothermal		
				Low	Medium	High
OTHER	Western Europe	Greece	1.2	0.1	0.2	0.3
OTHER	Western Europe	Ireland	0.1	0.0	0.1	0.1
OTHER	Western Europe	Italy	8.4	0.4	0.8	1.3
OTHER	Western Europe	Liechtenstein	0.0	0.0	0.0	0.0
OTHER	Western Europe	Luxembourg	0.0	0.0	0.0	0.0
OTHER	Western Europe	Malta	0.0	0.0	0.0	0.0
OTHER	Western Europe	Monaco	0.0	0.0	0.0	0.0
OTHER	Western Europe	Netherlands	0.0	0.0	0.0	0.0
OTHER	Western Europe	Norway	16.0	0.1	0.2	0.3
OTHER	Western Europe	Portugal	2.0	0.0	0.0	0.0
OTHER	Western Europe	San Marino	0.0	0.0	0.0	0.0
OTHER	Western Europe	Spain	5.6	0.8	1.7	2.8
OTHER	Western Europe	Sweden	10.4	0.0	0.0	0.0
OTHER	Western Europe	Switzerland	3.3	0.0	0.1	0.1
OTHER	Western Europe	United Kingdom	0.2	0.1	0.2	0.4
SAR	Indian Ocean Islands	Maldives	0.0	0.0	0.0	0.0
SAR	Southern Asia	Bangladesh	0.2	0.0	0.0	0.0
SAR	Southern Asia	Bhutan	5.6	0.0	0.0	0.0
SAR	Southern Asia	India	52.8	0.0	0.1	0.1
SAR	Southern Asia	Nepal	12.6	0.0	0.0	0.0
SAR	Southern Asia	Sri Lanka	0.6	0.0	0.0	0.0
SAR	Western Asia	Afghanistan	0.0	0.0	0.0	0.0
SAR	Western Asia	Pakistan	10.4	0.0	0.0	0.0

Table A2.3: Annual Renewable Energy: Biofuels
(Millions of tons of oil equivalent)

Region	Subregion	Country	Sugar Crops[a] (Ethanol)	Manure (Biogas)	Savanna Tallgrass[b] (Ethanol)	Jatropha (Biodiesel)
AFR	Central Africa	Angola	69.7	0.2	0.0	121.9
AFR	Central Africa	Burundi	0.6	0.0	0.0	2.0
AFR	Central Africa	Cameroon	32.9	0.3	0.0	23.5
AFR	Central Africa	Central African Rep	71.4	0.1	0.0	60.5
AFR	Central Africa	Congo	12.5	0.0	0.0	12.2
AFR	Central Africa	Congo, Dem Rep	107.4	0.1	0.0	128.0
AFR	Central Africa	Gabon	13.0	0.0	0.0	4.9
AFR	Central Africa	Rwanda	0.1	0.0	0.0	1.5
AFR	Central Africa	Zambia	66.0	0.1	0.0	69.1
AFR	Coastal West Africa	Benin	10.8	0.1	0.0	12.5
AFR	Coastal West Africa	Cape Verde	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Côte d'Ivoire	31.5	0.1	0.0	18.8
AFR	Coastal West Africa	Equatorial Guinea	1.4	0.0	0.0	0.0
AFR	Coastal West Africa	Gambia	0.8	0.0	0.0	1.1
AFR	Coastal West Africa	Ghana	21.1	0.1	0.0	17.2
AFR	Coastal West Africa	Guinea	14.9	0.2	0.0	21.2
AFR	Coastal West Africa	Guinea-Bissau	1.8	0.0	0.0	2.6
AFR	Coastal West Africa	Liberia	8.6	0.0	0.0	0.0
AFR	Coastal West Africa	Nigeria	67.0	0.9	0.0	81.2
AFR	Coastal West Africa	Sao Tome & Principe	0.0	0.0	0.0	0.0
AFR	Coastal West Africa	Senegal	10.4	0.2	0.0	21.2
AFR	Coastal West Africa	Sierra Leone	3.2	0.0	0.0	2.0
AFR	Coastal West Africa	Togo	5.9	0.0	0.0	5.6
AFR	East Africa	Djibouti	0.0	0.0	0.0	2.1
AFR	East Africa	Eritrea	0.5	0.1	0.0	10.3
AFR	East Africa	Ethiopia	36.7	1.6	0.0	69.6
AFR	East Africa	Kenya	17.6	0.5	0.0	53.6
AFR	East Africa	Malawi	8.8	0.1	0.0	7.8
AFR	East Africa	Somalia	2.6		0.0	59.2
AFR	East Africa	Sudan	105.2	1.8	0.0	214.5
AFR	East Africa	Tanzania	85.7	0.7	0.0	79.0
AFR	East Africa	Uganda	19.0	0.3	0.0	20.2
AFR	Indian Ocean Islands	Comoros	0.0	0.0	0.0	0.0
AFR	Indian Ocean Islands	Mauritius	0.0	0.0	0.0	0.0
AFR	Indian Ocean Islands	Seychelles	0.0	0.0	0.0	0.0
AFR	Madagascar	Madagascar	41.4	0.4	0.0	13.3
AFR	Sahelian Africa	Burkina Faso	23.5	0.4	0.0	29.7
AFR	Sahelian Africa	Chad	37.7	0.3	0.0	90.7
AFR	Sahelian Africa	Mali	27.0	0.4	0.0	99.9
AFR	Sahelian Africa	Mauritania	0.9	0.1	0.0	86.7
AFR	Sahelian Africa	Niger	6.8	0.1	0.0	83.0
AFR	Southern Africa	Botswana	5.5	0.1	0.0	58.0
AFR	Southern Africa	Lesotho	0.4	0.0	0.0	0.0
AFR	Southern Africa	Mozambique	89.4	0.1	0.0	65.0
AFR	Southern Africa	Namibia	8.6	0.1	0.0	77.3

Region	Subregion	Country	Sugar Crops[a] (Ethanol)	Manure (Biogas)	Savanna Tallgrass[b] (Ethanol)	Jatropha (Biodiesel)
AFR	Southern Africa	South Africa	27.3	0.8	0.0	77.6
AFR	Southern Africa	Swaziland	0.7	0.0	0.0	0.8
AFR	Southern Africa	Zimbabwe	21.0	0.2	0.0	41.8
EAP	China	China	228.7	16.5	401.8	0.0
EAP	Northeast Asia	Korea, Rep	6.4	0.3	0.0	0.0
EAP	Northeast Asia	Mongolia	0.0	0.1	381.9	0.0
EAP	Pacific Islands	Fiji	0.7	0.0	0.0	0.0
EAP	Pacific Islands	Kiribati	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Marshall Islands	0.0		0.0	0.0
EAP	Pacific Islands	Micronesia, Fed States	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Pacific Islands (Palau)	0.0		0.0	0.0
EAP	Pacific Islands	Samoa	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Solomon Islands	0.6	0.0	0.0	0.0
EAP	Pacific Islands	Timor-Leste	0.6	0.0	0.0	0.0
EAP	Pacific Islands	Tonga	0.0	0.0	0.0	0.0
EAP	Pacific Islands	Vanuatu	0.0	0.0	0.0	0.0
EAP	Southeast Asia	Cambodia	12.4	0.2	0.0	0.0
EAP	Southeast Asia	Indonesia	59.4	2.3	0.0	0.9
EAP	Southeast Asia	Lao People's Dem Rep	3.9	0.1	0.0	0.0
EAP	Southeast Asia	Malaysia	10.0	0.3	0.0	0.0
EAP	Southeast Asia	Myanmar	15.8	0.7	0.0	0.0
EAP	Southeast Asia	Papua New Guinea	7.1	0.0	0.0	2.0
EAP	Southeast Asia	Philippines	13.0	0.5	0.0	0.0
EAP	Southeast Asia	Thailand	36.7	0.7	0.0	0.0
EAP	Southeast Asia	Viet Nam	13.3	0.9	0.0	0.0
ECA	Eastern Europe	Albania	0.7	0.0	0.0	0.0
ECA	Eastern Europe	Armenia	0.1	0.0	9.1	0.0
ECA	Eastern Europe	Belarus	31.0	0.2	0.0	0.0
ECA	Eastern Europe	Bosnia and Herzegovina	3.9	0.0	0.0	0.0
ECA	Eastern Europe	Bulgaria	5.9	0.1	0.3	0.0
ECA	Eastern Europe	Croatia	5.4	0.0	0.0	0.0
ECA	Eastern Europe	Czech Rep	11.7	0.1	0.0	0.0
ECA	Eastern Europe	Estonia	1.9	0.0	0.0	0.0
ECA	Eastern Europe	Georgia	2.7	0.1	3.5	0.0
ECA	Eastern Europe	Hungary	15.2	0.1	0.0	0.0
ECA	Eastern Europe	Latvia	7.9	0.0	0.0	0.0
ECA	Eastern Europe	Lithuania	9.4	0.0	0.0	0.0
ECA	Eastern Europe	Macedonia, FYR	0.1	0.0	0.0	0.0
ECA	Eastern Europe	Moldova, Rep	3.9	0.0	4.8	0.0
ECA	Eastern Europe	Poland	32.7	0.5	0.0	0.0
ECA	Eastern Europe	Romania	26.1	0.3	15.3	0.0
ECA	Eastern Europe	Russian Federation	298.3	1.5	947.3	0.0
ECA	Eastern Europe	Serbia and Montenegro	9.8	0.1	0.0	0.0
ECA	Eastern Europe	Slovakia	4.8	0.0	0.0	0.0
ECA	Eastern Europe	Slovenia	1.3	0.0	0.0	0.0
ECA	Eastern Europe	Ukraine	79.5	0.5	151.9	0.0
ECA	Middle East	Turkey	5.8	0.9	66.6	0.0
ECA	Western Asia	Azerbaijan	1.3	0.2	3.2	0.0

Region	Subregion	Country	Sugar Crops[a] (Ethanol)	Manure (Biogas)	Savanna Tallgrass[b] (Ethanol)	Jatropha (Biodiesel)
ECA	Western Asia	Kazakhstan	9.7	0.3	690.8	5.1
ECA	Western Asia	Kyrgyzstan	0.0	0.1	61.5	0.0
ECA	Western Asia	Tajikistan	0.3	0.1	41.6	0.0
ECA	Western Asia	Turkmenistan	0.5	0.2	2.3	1.5
ECA	Western Asia	Uzbekistan	0.9	0.3	68.6	3.1
LCR	Andean South America	Bolivia	60.0	0.4	0.0	14.4
LCR	Andean South America	Colombia	38.5	1.1	0.0	19.7
LCR	Andean South America	Ecuador	8.3	0.3	0.0	0.8
LCR	Andean South America	Peru	8.0	0.4	0.0	0.0
LCR	Caribbean Islands	Antigua and Barbuda	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Barbados	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Dominica	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Dominican Rep	2.3	0.1	0.0	0.0
LCR	Caribbean Islands	Grenada	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Haiti	1.0	0.1	0.0	0.0
LCR	Caribbean Islands	Jamaica	0.3	0.0	0.0	0.0
LCR	Caribbean Islands	Saint Kitts and Nevis	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	St. Lucia	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	St. Vincent & Grenadines	0.0	0.0	0.0	0.0
LCR	Caribbean Islands	Trinidad and Tobago	0.0	0.0	0.0	0.0
LCR	Central America	Belize	0.0	0.0	0.0	0.0
LCR	Central America	Costa Rica	0.9	0.1	0.0	0.0
LCR	Central America	El Salvador	0.9	0.1	0.0	0.0
LCR	Central America	Guatemala	3.4	0.1	0.0	0.3
LCR	Central America	Honduras	2.9	0.1	0.0	0.0
LCR	Central America	Mexico	48.0	1.9	0.0	35.3
LCR	Central America	Nicaragua	4.7	0.2	0.0	0.0
LCR	Central America	Panama	2.3	0.1	0.0	0.0
LCR	Northern South America	Brazil	434.0	9.0	0.0	314.3
LCR	Northern South America	Guyana	5.5	0.0	0.0	1.3
LCR	Northern South America	Suriname	1.9	0.0	0.0	0.1
LCR	Northern South America	Venezuela	43.8	0.8	0.0	37.2
LCR	Southern South America	Argentina	266.0	2.1	1001.9	33.3
LCR	Southern South America	Chile	1.7	0.3	23.3	0.0
LCR	Southern South America	Paraguay	30.2	0.4	0.0	14.9
LCR	Southern South America	Uruguay	53.7	0.5	0.0	19.3
MNA	Middle East	Iraq	1.9		24.0	21.1
MNA	Middle East	Jordan	0.1	0.0	7.3	3.9
MNA	Middle East	Lebanon	0.1	0.0	0.0	0.0
MNA	Middle East	Oman	0.0	0.0	16.1	12.9
MNA	Middle East	Syrian Arab Rep	1.0	0.2	51.7	0.0
MNA	Middle East	West Bank and Gaza	0.0	0.0	0.0	0.0
MNA	Middle East	Yemen	0.0	0.1	0.0	20.2
MNA	North Africa	Algeria	4.4	0.3	0.0	69.6
MNA	North Africa	Egypt	0.0	0.5	0.0	13.3
MNA	North Africa	Libyan Arab Jamahiriya	2.4	0.1	0.0	37.5
MNA	North Africa	Morocco	12.7	0.4	0.0	8.7
MNA	North Africa	Tunisia	3.5	0.1	0.0	6.9

Region	Subregion	Country	Sugar Crops[a] (Ethanol)	Manure (Biogas)	Savanna Tallgrass[b] (Ethanol)	Jatropha (Biodiesel)
MNA	Western Asia	Iran, Islamic Rep	1.2	1.0	40.6	0.3
OTHER	Atlantic Islands	Channel Islands	0.0		0.0	0.0
OTHER	Atlantic Islands	Faeroe Islands	0.0	0.0	0.0	0.0
OTHER	Atlantic Islands	Greenland	0.0	0.0	0.0	0.0
OTHER	Atlantic Islands	Iceland	0.0	0.0	0.0	0.0
OTHER	Atlantic Islands	Isle of Man	0.0		0.0	0.0
OTHER	AustraliaNZ	Australia	142.4	1.8	364.4	363.1
OTHER	AustraliaNZ	New Zealand	5.1	0.6	33.7	0.0
OTHER	Caribbean Islands	Aruba	0.0		0.0	0.0
OTHER	Caribbean Islands	Bahamas	2.3	0.0	0.0	0.0
OTHER	Caribbean Islands	Bermuda	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Cayman Islands	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Cuba	14.8	0.2	0.0	0.3
OTHER	Caribbean Islands	Netherlands Antilles	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Puerto Rico	0.0	0.0	0.0	0.0
OTHER	Caribbean Islands	Virgin Islands	0.0		0.0	0.0
OTHER	Indian Ocean Islands	Mayotte	0.0		0.0	0.0
OTHER	Middle East	Bahrain	0.0	0.0	0.0	0.0
OTHER	Middle East	Israel	0.7	0.1	0.0	1.1
OTHER	Middle East	Kuwait	0.0	0.0	0.0	0.1
OTHER	Middle East	Qatar	0.0	0.0	0.0	0.7
OTHER	Middle East	Saudi Arabia	0.0	0.2	0.0	159.7
OTHER	Middle East	United Arab Emirates	0.0	0.0	0.1	6.2
OTHER	North America	Canada	47.7	0.9	432.3	0.0
OTHER	North America	United States	604.2	6.5	1522.1	124.8
OTHER	Northeast Asia	Japan	15.9	0.6	0.0	0.0
OTHER	Northeast Asia	Korea, Dem People's Rep	7.5	0.1	0.0	0.0
OTHER	Northeast Asia	Taiwan	0.0		0.0	0.0
OTHER	Pacific Islands	American Samoa	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Cook Islands	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	French Polynesia	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Guam	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Nauru	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	New Caledonia	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Niue	0.0	0.0	0.0	0.0
OTHER	Pacific Islands	Northern Mariana Islands	0.0		0.0	0.0
OTHER	Pacific Islands	Tuvalu	0.0	0.0	0.0	0.0
OTHER	Southeast Asia	Brunei Darussalam	0.0	0.0	0.0	0.0
OTHER	Southeast Asia	Singapore	0.0	0.0	0.0	0.0
OTHER	Western Europe	Andorra	0.0		0.0	0.0
OTHER	Western Europe	Austria	6.0	0.1	0.0	0.0
OTHER	Western Europe	Belgium	3.1	0.2	0.0	0.0
OTHER	Western Europe	Cyprus	0.0	0.0	0.0	0.0
OTHER	Western Europe	Denmark	5.2	0.2	0.0	0.0
OTHER	Western Europe	Finland	0.4	0.1	0.0	0.0
OTHER	Western Europe	France	63.4	1.2	0.0	0.0
OTHER	Western Europe	Germany	44.8	0.8	0.0	0.0
OTHER	Western Europe	Gibraltar	0.0		0.0	0.0

Region	Subregion	Country	Sugar Crops[a] (Ethanol)	Manure (Biogas)	Savanna Tallgrass[b] (Ethanol)	Jatropha (Biodiesel)
OTHER	Western Europe	Greece	3.7	0.1	0.0	0.0
OTHER	Western Europe	Ireland	4.6	0.3	0.0	0.0
OTHER	Western Europe	Italy	18.5	0.5	0.0	0.0
OTHER	Western Europe	Liechtenstein	0.0	0.0	0.0	0.0
OTHER	Western Europe	Luxembourg	0.0	0.1	0.0	0.0
OTHER	Western Europe	Malta	0.0	0.0	0.0	0.0
OTHER	Western Europe	Monaco	0.0		0.0	0.0
OTHER	Western Europe	Netherlands	0.6	0.3	0.0	0.0
OTHER	Western Europe	Norway	0.1	0.1	0.0	0.0
OTHER	Western Europe	Portugal	6.3	0.1	0.0	0.0
OTHER	Western Europe	San Marino	0.0		0.0	0.0
OTHER	Western Europe	Spain	8.8	0.7	0.0	0.0
OTHER	Western Europe	Sweden	3.3	0.1	0.0	0.0
OTHER	Western Europe	Switzerland	2.0	0.1	0.0	0.0
OTHER	Western Europe	United Kingdom	16.3	0.8	0.0	0.0
SAR	Indian Ocean Islands	Maldives	0.0		0.0	0.0
SAR	Southern Asia	Bangladesh	17.9	1.2	0.0	0.0
SAR	Southern Asia	Bhutan	0.0	0.0	0.0	0.0
SAR	Southern Asia	India	249.0	12.9	0.0	64.5
SAR	Southern Asia	Nepal	3.4	0.5	0.0	2.5
SAR	Southern Asia	Sri Lanka	6.1	0.1	0.0	0.2
SAR	Western Asia	Afghanistan	0.8		2.2	28.9
SAR	Western Asia	Pakistan	10.1	2.6	0.0	54.3

[a] Sugar cane, sugar beets, sorghum
[b] US species: switchgrass

Table A2.4: Climate Change Impacts: Sea Level Rise and Weather Events

			% GDP Affected			Population Affected by Weather Events, 1960 - 2002			
Region	Subregion	Country	SLR (1 meter)	SLR (2 meters)	SLR (3 meters)	Killed	Homeless	Affected	Population 1980
AFR	Central Africa	Angola	0.17	0.47	0.76	152	32,000	3,909,928	7,048,000
AFR	Central Africa	Burundi				18	500	1,154,720	4,130,000
AFR	Central Africa	Cameroon	0.08	0.14	0.19	69	3,200	401,000	8,754,000
AFR	Central Africa	Central African Rep				11	43,226	51,942	2,313,000
AFR	Central Africa	Congo	0.00	0.05	0.10	2	2,000	81,500	1,804,000
AFR	Central Africa	Congo, Dem Rep	0.02	0.04	0.05	119	37,056	919,000	27,909,000
AFR	Central Africa	Gabon	0.12	0.27	0.42	0	0	10,000	695,000
AFR	Central Africa	Rwanda				128	18,000	5,231,173	5,163,000
AFR	Central Africa	Zambia				28	0	7,863,734	5,738,000
AFR	Coastal West Africa	Benin	5.64	10.20	14.76	100	289,295	3,816,901	3,459,000
AFR	Coastal West Africa	Cape Verde		15.00		32	0	7,600	289,000
AFR	Coastal West Africa	Côte d'Ivoire	1.11	1.16	1.21	28	0	7,000	8,194,000
AFR	Coastal West Africa	Equatorial Guinea	0.00	0.11	0.21				
AFR	Coastal West Africa	Gambia	0.74	4.17	7.60	54	10,000	861,250	641,000
AFR	Coastal West Africa	Ghana	0.84	1.11	1.37	229	242,500	974,073	11,043,000
AFR	Coastal West Africa	Guinea	0.32	1.82	3.31	25	0	231,066	4,461,000
AFR	Coastal West Africa	Guinea-Bissau	0.43	1.13	1.83	4	4,000	102,922	793,000
AFR	Coastal West Africa	Liberia	1.07	1.16	1.25	10	2,000	1,005,000	1,876,000
AFR	Coastal West Africa	Nigeria	0.23	0.91	1.58	744	635,002	3,629,500	71,148,000
AFR	Coastal West Africa	Sao Tome & Principe		15.00		0	0	93,000	89,000
AFR	Coastal West Africa	Senegal	1.14	4.63	8.12	215	57,500	7,822,851	5,538,000
AFR	Coastal West Africa	Sierra Leone	0.18	0.57	0.96	86	0	210,000	3,236,000
AFR	Coastal West Africa	Togo	0.15	0.19	0.23	3	76,500	705,405	2,519,000
AFR	East Africa	Djibouti	0.34	0.54	0.74	180	32,000	1,257,775	300,000
AFR	East Africa	Eritrea				3	15,659	1,973,000	2,382,000
AFR	East Africa	Ethiopia	0.35	0.00	0.37	602,981	205,800	77,256,915	37,717,000
AFR	East Africa	Kenya	0.14	0.22	0.30	562	3,200	16,421,600	16,632,000
AFR	East Africa	Malawi				1,057	131,300	23,056,025	6,183,000
AFR	East Africa	Somalia	0.09	0.14	0.19	22,371	480,000	5,054,000	6,487,000
AFR	East Africa	Sudan	0.02	0.04	0.06	150,443	1,254,700	30,516,706	19,367,000
AFR	East Africa	Tanzania	0.06	0.09	0.11	545	87,052	11,540,430	18,581,000
AFR	East Africa	Uganda				292	30,730	2,639,616	12,806,900
AFR	Indian Ocean Islands	Comoros		15.00		59	50,000	65,000	335,000

			% GDP Affected			Population Affected by Weather Events, 1960 - 2002			
Region	Subregion	Country	SLR (1 meter)	SLR (2 meters)	SLR (3 meters)	Killed	Homeless	Affected	Population 1980
AFR	Indian Ocean Islands	Mauritius		15.00		68	12,500	1,014,849	966,000
AFR	Indian Ocean Islands	Seychelles		15.00		5	110	7,925	64,400
AFR	Madagascar	Madagascar	0.23	0.45	0.67	1,422	398,850	9,012,912	8,873,000
AFR	Sahelian Africa	Burkina Faso				44	12,232	5,904,824	6,962,000
AFR	Sahelian Africa	Chad				3,208	119,843	7,236,721	4,477,000
AFR	Sahelian Africa	Mali				42	44,850	3,723,918	6,590,000
AFR	Sahelian Africa	Mauritania	9.35	13.42	17.48	35	24,252	6,688,475	1,609,000
AFR	Sahelian Africa	Niger				104	94,781	9,826,069	5,586,000
AFR	Southern Africa	Botswana				31	34,000	4,486,716	906,000
AFR	Southern Africa	Lesotho				41	1,020	1,386,730	1,277,000
AFR	Southern Africa	Mozambique	0.27	0.60	0.93	102,321	570,550	29,102,676	12,095,000
AFR	Southern Africa	Namibia	0.03	0.03	0.03	0	0	788,200	1,018,000
AFR	Southern Africa	South Africa	0.01	0.03	0.04	1,482	34,235	1,055,106	27,576,000
AFR	Southern Africa	Swaziland				553	500	1,429,000	565,000
AFR	Southern Africa	Zimbabwe				130	66,000	27,285,000	7,133,000
EAP	China	China	2.40	4.00	5.59	44,664	48,997,820	1,649,290,469	981,235,000
EAP	Northeast Asia	Korea, Rep	0.21	0.41	0.60	5,917	1,064,653	7,862,128	38,124,000
EAP	Northeast Asia	Mongolia				202	20,000	2,720,000	1,663,000
EAP	Pacific Islands	Fiji		15.00		272	46,772	1,227,906	634,000
EAP	Pacific Islands	Kiribati		15.00		3	0	84,700	58,100
EAP	Pacific Islands	Marshall Islands		15.00		0	6,000	0	31,000
EAP	Pacific Islands	Micronesia, Fed States		15.00		52	400	30,100	71,000
EAP	Pacific Islands	Pacific Islands (Palau)		15.00					
EAP	Pacific Islands	Samoa		15.00		281	28,000	352,000	155,000
EAP	Pacific Islands	Solomon Islands		15.00		123	61,300	216,530	229,000
EAP	Pacific Islands	Timor-Leste				1	0	2,508	581,000
EAP	Pacific Islands	Tonga		15.00		13	50,200	141,321	94,000
EAP	Pacific Islands	Vanuatu		15.00		101	10,895	180,655	115,060
EAP	Southeast Asia	Cambodia	1.06	3.01	4.95	1,104	285,805	10,150,756	6,613,000
EAP	Southeast Asia	Indonesia	1.88	3.41	4.94	14,991	202,535	12,443,592	148,303,000
EAP	Southeast Asia	Lao People's Dem Rep				474	1,017,600	7,707,990	3,205,000
EAP	Southeast Asia	Malaysia	0.55	1.15	1.75	508	26,000	842,087	13,763,000
EAP	Southeast Asia	Myanmar	0.96	2.47	3.97	2,052	421,689	2,905,672	33,705,000
EAP	Southeast Asia	Papua New Guinea	0.06	0.09	0.11	193	100,500	896,000	3,086,000
EAP	Southeast Asia	Philippines	0.62	1.37	2.12	29,148	8,612,886	72,845,075	48,035,000

			% GDP Affected			Population Affected by Weather Events, 1960 - 2002			
Region	Subregion	Country	SLR (1 meter)	SLR (2 meters)	SLR (3 meters)	Killed	Homeless	Affected	Population 1980
EAP	Southeast Asia	Thailand	1.42	4.44	7.46	3,859	271,370	42,957,077	46,718,000
EAP	Southeast Asia	Viet Nam	10.21	17.19	24.17	20,589	3,866,240	66,824,929	53,700,000
ECA	Eastern Europe	Albania				89	1,340	3,459,129	2,671,000
ECA	Eastern Europe	Armenia				4	144	304,000	3,096,000
ECA	Eastern Europe	Belarus				7	300	63,045	9,643,000
ECA	Eastern Europe	Bosnia and Herzegovina				0	90	10,000	4,092,000
ECA	Eastern Europe	Bulgaria	0.13	0.16	0.19	17	1,000	5,500	8,862,000
ECA	Eastern Europe	Croatia				41	0	1,200	4,588,000
ECA	Eastern Europe	Czech Rep				47	11,973	287,725	10,232,000
ECA	Eastern Europe	Estonia	1.30	1.42	1.53				
ECA	Eastern Europe	Georgia	1.44	1.72	1.99	1	200	1,220,200	5,073,000
ECA	Eastern Europe	Hungary				434	2,254	144,871	10,707,000
ECA	Eastern Europe	Latvia				21	0	0	2,544,000
ECA	Eastern Europe	Lithuania				58	0	780,000	3,413,000
ECA	Eastern Europe	Macedonia, FYR				15	150	3,000	1,889,000
ECA	Eastern Europe	Moldova, Rep				60	26,349	2,628,608	4,002,000
ECA	Eastern Europe	Poland	0.72	0.79	0.85	936	63,824	199,900	35,578,000
ECA	Eastern Europe	Romania	0.51	0.53	0.56				
ECA	Eastern Europe	Russian Federation				2,275	41,532	2,515,010	139,010,000
ECA	Eastern Europe	Serbia and Montenegro							
ECA	Eastern Europe	Slovakia				62	1,697	46,057	4,984,300
ECA	Eastern Europe	Slovenia							
ECA	Eastern Europe	Ukraine	1.26	1.40	1.54	41	24,340	2,456,400	50,043,000
ECA	Middle East	Turkey	0.70	0.90	1.10	834	850	114,566	44,484,000
ECA	Western Asia	Azerbaijan				16	156,000	1,577,800	6,166,000
ECA	Western Asia	Kazakhstan				125	0	644,168	14,873,500
ECA	Western Asia	Kyrgyzstan				12	7,728	0	3,632,000
ECA	Western Asia	Tajikistan				1,467	69,817	3,385,569	3,966,000
ECA	Western Asia	Turkmenistan				0	120	300	2,861,000
ECA	Western Asia	Uzbekistan				0	0	1,100,000	15,952,000
LCR	Andean South America	Bolivia				602	134,875	4,692,921	5,355,000
LCR	Andean South America	Colombia	0.20	0.48	0.76	1,818	299,163	7,045,489	28,447,000
LCR	Andean South America	Ecuador	2.66	3.52	4.37	743	115,436	2,031,107	7,961,000
LCR	Andean South America	Peru	0.64	0.84	1.03	2,596	295,800	7,099,780	17,324,000
LCR	Caribbean Islands	Antigua and Barbuda		15.00		9	7,506	152,000	61,000

			% GDP Affected			Population Affected by Weather Events, 1960 - 2002			
Region	Subregion	Country	SLR (1 meter)	SLR (2 meters)	SLR (3 meters)	Killed	Homeless	Affected	Population 1980
LCR	Caribbean Islands	Barbados		15.00		3	7,330	200	249,100
LCR	Caribbean Islands	Dominica		15.00		46	315	84,285	73,350
LCR	Caribbean Islands	Dominican Rep	0.15	0.35	0.55	2,391	479,000	3,694,095	5,695,000
LCR	Caribbean Islands	Grenada		15.00		6	0	1,210	90,100
LCR	Caribbean Islands	Haiti	0.08	0.19	0.30	8,204	101,765	4,361,457	5,353,000
LCR	Caribbean Islands	Jamaica	0.67	0.92	1.16	209	52,722	1,765,290	2,133,000
LCR	Caribbean Islands	Saint Kitts and Nevis		15.00		6	1,400	12,880	44,400
LCR	Caribbean Islands	St. Lucia		15.00		68	10,350	73,600	115,500
LCR	Caribbean Islands	St. Vincent & Grenadines		15.00		5	700	21,442	97,800
LCR	Caribbean Islands	Trinidad and Tobago		15.00		31	10	51,200	1,082,000
LCR	Central America	Belize	2.06	3.81	5.56	324	0	237,600	146,000
LCR	Central America	Costa Rica	0.11	0.20	0.29	166	37,627	1,210,401	2,284,000
LCR	Central America	El Salvador	0.28	0.44	0.60	1,056	2,000	607,350	4,586,000
LCR	Central America	Guatemala	0.02	0.05	0.07	1,510	4,270	457,204	6,820,000
LCR	Central America	Honduras	0.08	0.24	0.40	23,719	58,339	4,895,042	3,567,000
LCR	Central America	Mexico	0.54	0.92	1.29	6,165	795,240	3,513,060	67,570,000
LCR	Central America	Nicaragua	0.10	0.29	0.48	4,059	72,169	2,274,683	2,921,000
LCR	Central America	Panama	0.85	1.28	1.71	159	9,170	197,477	1,950,000
LCR	Northern South America	Brazil	0.58	0.90	1.22	5,614	1,036,928	59,130,146	121,616,000
LCR	Northern South America	Guyana	4.64	9.56	14.47	0	10,000	656,200	761,000
LCR	Northern South America	Suriname	6.42	13.14	19.86	0	0	4,600	355,000
LCR	Northern South America	Venezuela	0.81	1.16	1.50	30,344	153,388	582,403	15,091,000
LCR	Southern South America	Argentina	0.31	0.85	1.38	786	539,054	13,092,400	28,094,000
LCR	Southern South America	Chile	0.08	0.13	0.18	1,458	305,134	1,564,521	11,147,000
LCR	Southern South America	Paraguay				140	100,000	978,470	3,114,000
LCR	Southern South America	Uruguay	1.48	2.34	3.20	19	6,800	83,263	2,914,000
MNA	Middle East	Iraq				0	60,000	850,000	13,007,000
MNA	Middle East	Jordan				340	2,500	351,700	2,181,000
MNA	Middle East	Lebanon				25	4,000	102,000	3,002,350
MNA	Middle East	Oman	0.84	1.10	1.36	140	1,500	5,050	1,101,000
MNA	Middle East	Syrian Arab Rep				27	75,000	828,000	8,704,000
MNA	Middle East	West Bank and Gaza							
MNA	Middle East	Yemen	0.49	0.54	0.59	550	164,650	148,510	8,538,000
MNA	North Africa	Algeria	0.52	0.59	0.65	1,481	129,420	501,292	18,669,170
MNA	North Africa	Egypt	6.44	9.29	12.13	799	53,200	192,660	40,875,000

			% GDP Affected			Population Affected by Weather Events, 1960 - 2002			
Region	Subregion	Country	SLR (1 meter)	SLR (2 meters)	SLR (3 meters)	Killed	Homeless	Affected	Population 1980
MNA	North Africa	Libyan Arab Jamahiriya	1.53	1.97	2.41	0	0	0	3,043,000
MNA	North Africa	Morocco	0.14	0.31	0.48	1,298	39,547	892,464	19,382,000
MNA	North Africa	Tunisia	2.93	3.90	4.87	917	50,500	446,659	6,384,000
MNA	Western Asia	Iran, Islamic Rep	0.24	0.42	0.59	3,715	194,750	65,990,201	39,124,000
OTHER	Atlantic Islands	Channel Islands		15.00					
OTHER	Atlantic Islands	Faeroe Islands		15.00					
OTHER	Atlantic Islands	Greenland							
OTHER	Atlantic Islands	Iceland				0	0	280	228,000
OTHER	Atlantic Islands	Isle of Man		15.00					
OTHER	AustraliaNZ	Australia	3.56	4.25	4.95	1,159	23,564	15,790,335	14,692,000
OTHER	AustraliaNZ	New Zealand	6.39	6.92	7.45	66	0	24,707	3,113,000
OTHER	Caribbean Islands	Aruba		15.00					
OTHER	Caribbean Islands	Bahamas	4.74	9.64	14.53	10	3,200	1,200	210,000
OTHER	Caribbean Islands	Bermuda		15.00		0	0	0	54,000
OTHER	Caribbean Islands	Cayman Islands		15.00					
OTHER	Caribbean Islands	Cuba	0.45	2.33	4.21	1,948	290,924	9,475,085	9,710,000
OTHER	Caribbean Islands	Netherlands Antilles		15.00		2	0	40,000	174,000
OTHER	Caribbean Islands	Puerto Rico	1.53	3.63	5.73	633	714	121,664	3,206,000
OTHER	Caribbean Islands	Virgin Islands		15.00		11	10,000	0	97,000
OTHER	Indian Ocean Islands	Mayotte		15.00					
OTHER	Middle East	Bahrain							
OTHER	Middle East	Israel				19	0	1,850	3,878,000
OTHER	Middle East	Kuwait	1.15	1.49	1.82	2	0	200	1,375,000
OTHER	Middle East	Qatar	1.81	3.06	4.31				
OTHER	Middle East	Saudi Arabia	0.15	0.23	0.30	71	5,000	1,000	9,372,000
OTHER	Middle East	United Arab Emirates	2.01	2.63	3.24				
OTHER	North America	Canada	4.49	6.69	8.90	175	4,330	640,400	24,593,000
OTHER	North America	United States	1.96	2.50	3.04	13,236	417,236	3,883,714	227,225,000
OTHER	Northeast Asia	Japan	2.98	3.80	4.63	5,606	188,696	6,224,401	116,782,000
OTHER	Northeast Asia	Korea, Dem People's Rep	0.10	0.26	0.42	770	699,542	9,724,907	17,196,000
OTHER	Northeast Asia	Taiwan	1.81	3.06	4.31				
OTHER	Pacific Islands	American Samoa		15.00					
OTHER	Pacific Islands	Cook Islands		15.00					
OTHER	Pacific Islands	French Polynesia		15.00		7	0	5,000	151,000
OTHER	Pacific Islands	Guam		15.00		21	15,602	11,444	107,000

			% GDP Affected			Population Affected by Weather Events, 1960 - 2002			
Region	Subregion	Country	SLR (1 meter)	SLR (2 meters)	SLR (3 meters)	Killed	Homeless	Affected	Population 1980
OTHER	Pacific Islands	Nauru		15.00					
OTHER	Pacific Islands	New Caledonia		15.00		9	0	2,000	143,000
OTHER	Pacific Islands	Niue		15.00					
OTHER	Pacific Islands	Northern Mariana Islands		15.00					
OTHER	Pacific Islands	Tuvalu		15.00					
OTHER	Southeast Asia	Brunei Darussalam	0.00	0.00	0.00				
OTHER	Southeast Asia	Singapore							
OTHER	Western Europe	Andorra							
OTHER	Western Europe	Austria				41	0	60,300	7,553,000
OTHER	Western Europe	Belgium	4.42	6.11	7.81	22	0	5,575	9,847,000
OTHER	Western Europe	Cyprus				60	0	3,000	611,000
OTHER	Western Europe	Denmark	100.00	100.00	100.00	19	0	0	5,123,000
OTHER	Western Europe	Finland	26.48	26.38	26.29	0	0	0	4,780,000
OTHER	Western Europe	France	1.20	1.53	1.87	508	406	3,891,991	53,880,000
OTHER	Western Europe	Germany	2.56	2.96	3.37	123	0	575,000	78,303,000
OTHER	Western Europe	Gibraltar							
OTHER	Western Europe	Greece	2.66	3.10	3.55	1,283	390	13,040	9,643,000
OTHER	Western Europe	Ireland	1.43	1.74	2.04	38	0	3,800	3,401,000
OTHER	Western Europe	Italy	2.93	3.37	3.81	887	14,950	1,470,800	56,434,000
OTHER	Western Europe	Liechtenstein							
OTHER	Western Europe	Luxembourg				0	0	0	364,900
OTHER	Western Europe	Malta		15.00					
OTHER	Western Europe	Monaco							
OTHER	Western Europe	Netherlands	43.57	48.04	52.52	6	0	264,060	14,150,000
OTHER	Western Europe	Norway				1	0	6,100	4,091,000
OTHER	Western Europe	Portugal	2.43	2.88	3.34	606	10,520	39,950	9,766,000
OTHER	Western Europe	San Marino							
OTHER	Western Europe	Spain	2.35	2.84	3.32	1,380	6,000	6,811,400	37,386,000
OTHER	Western Europe	Sweden	0.98	1.45	1.92	12	0	0	8,310,000
OTHER	Western Europe	Switzerland				20	0	421	6,319,000
OTHER	Western Europe	United Kingdom	1.72	2.58	3.44	294	0	489,570	56,330,000
SAR	Indian Ocean Islands	Maldives		15.00		0	23,849	300	158,000
SAR	Southern Asia	Bangladesh	0.94	2.39	3.84	597,533	70,753,667	352,587,784	85,438,000
SAR	Southern Asia	Bhutan				239	1,000	65,600	487,880
SAR	Southern Asia	India	0.59	1.08	1.57	1,608,883	17,263,130	2,105,274,285	687,332,000

			% GDP Affected			Population Affected by Weather Events, 1960 - 2002			
Region	Subregion	Country	SLR (1 meter)	SLR (2 meters)	SLR (3 meters)	Killed	Homeless	Affected	Population 1980
SAR	Southern Asia	Nepal				5,188	123,350	5,861,215	14,559,000
SAR	Southern Asia	Sri Lanka	0.45	1.01	1.57	1,651	2,847,601	16,278,127	14,603,000
SAR	Western Asia	Afghanistan				2,429	76,550	8,524,744	15,950,000
SAR	Western Asia	Pakistan	0.10	0.22	0.33	19,886	8,934,282	33,039,288	82,730,330

Note: For most small island states, available data did not allow estimation of GDP affected. We therefore assume a value of 15 percent at 2m SLR which is similar to that for the Bahamas.

Table A2.5: Sequestration Potential (Reduction of Deforestation, Storage)

Region	Subregion	Country	Annual CO2 Emissions (Mt) Deforestation	Total	CO2 Storage Potential / Annual Emissions
AFR	Central Africa	Angola	17.8	51.7	156.934
AFR	Central Africa	Burundi	7.3	10.4	0.000
AFR	Central Africa	Cameroon	77.1	107.2	0.721
AFR	Central Africa	Central African Rep	9.0	20.4	0.000
AFR	Central Africa	Congo	9.9	16.9	53.624
AFR	Central Africa	Congo, Dem Rep	317.3	369.0	0.012
AFR	Central Africa	Gabon	3.6	13.5	182.262
AFR	Central Africa	Rwanda	7.5	11.3	0.000
AFR	Central Africa	Zambia	235.5	253.2	0.000
AFR	Coastal West Africa	Benin	36.2	43.6	3.167
AFR	Coastal West Africa	Cape Verde	0.0	0.1	
AFR	Coastal West Africa	Côte d'Ivoire	91.2	106.3	7.456
AFR	Coastal West Africa	Equatorial Guinea	4.4	6.9	282.696
AFR	Coastal West Africa	Gambia	-0.3	1.1	9939.023
AFR	Coastal West Africa	Ghana	27.9	48.6	27.400
AFR	Coastal West Africa	Guinea	10.4	19.6	38.082
AFR	Coastal West Africa	Guinea-Bissau	1.1	3.0	406.341
AFR	Coastal West Africa	Liberia	39.4	41.7	24.645
AFR	Coastal West Africa	Nigeria	194.8	388.3	101.104
AFR	Coastal West Africa	Sao Tome & Principe	0.0	0.1	7582.267
AFR	Coastal West Africa	Senegal	3.6	22.5	105.614
AFR	Coastal West Africa	Sierra Leone	13.3	17.3	48.764
AFR	Coastal West Africa	Togo	8.6	14.5	4.723
AFR	East Africa	Djibouti	0.0	1.7	14.307
AFR	East Africa	Eritrea	0.0	0.6	
AFR	East Africa	Ethiopia	8.5	67.4	0.000
AFR	East Africa	Kenya	12.0	64.7	4.047
AFR	East Africa	Malawi	26.7	33.2	0.000
AFR	East Africa	Somalia			
AFR	East Africa	Sudan	30.5	126.8	4.188
AFR	East Africa	Tanzania	14.5	73.7	10.737
AFR	East Africa	Uganda	39.3	66.3	0.000
AFR	Indian Ocean Islands	Comoros	0.0	0.4	
AFR	Indian Ocean Islands	Mauritius	0.0	4.0	
AFR	Indian Ocean Islands	Seychelles	0.0	0.6	
AFR	Madagascar	Madagascar	60.3	91.7	14.991
AFR	Sahelian Africa	Burkina Faso	0.6	21.6	0.000
AFR	Sahelian Africa	Chad	3.5	21.3	81.024
AFR	Sahelian Africa	Mali	8.0	33.4	0.000
AFR	Sahelian Africa	Mauritania	0.0	13.6	
AFR	Sahelian Africa	Niger	0.7	12.9	0.000
AFR	Southern Africa	Botswana	19.7	35.1	0.000

			Annual CO2 Emissions (Mt)		CO2 Storage Potential / Annual Emissions
Region	Subregion	Country	Deforestation	Total	
AFR	Southern Africa	Lesotho	0.0	2.9	0.000
AFR	Southern Africa	Mozambique	9.3	24.2	41.732
AFR	Southern Africa	Namibia	2.2	12.5	917.112
AFR	Southern Africa	South Africa	1.7	419.1	50.123
AFR	Southern Africa	Swaziland	-1.7	1.5	
AFR	Southern Africa	Zimbabwe	47.4	80.4	0.000
EAP	China	China	-47.3	4890.4	53.543
EAP	Northeast Asia	Korea, Rep	1.2	522.1	2.694
EAP	Northeast Asia	Mongolia	0.5	28.3	0.000
EAP	Pacific Islands	Fiji	0.1	3.5	0.000
EAP	Pacific Islands	Kiribati	0.0	0.1	
EAP	Pacific Islands	Marshall Islands			
EAP	Pacific Islands	Micronesia, Fed States			
EAP	Pacific Islands	Pacific Islands (Palau)	0.0	0.2	
EAP	Pacific Islands	Samoa	0.1	0.2	0.000
EAP	Pacific Islands	Solomon Islands	0.2	0.6	0.000
EAP	Pacific Islands	Timor-Leste			
EAP	Pacific Islands	Tonga	0.0	0.3	0.000
EAP	Pacific Islands	Vanuatu	0.0	0.9	0.000
EAP	Southeast Asia	Cambodia	56.2	124.8	0.534
EAP	Southeast Asia	Indonesia	2563.0	3065.6	13.679
EAP	Southeast Asia	Lao People's Dem Rep	23.6	30.9	0.000
EAP	Southeast Asia	Malaysia	699.0	865.2	22.034
EAP	Southeast Asia	Myanmar	425.4	508.1	7.788
EAP	Southeast Asia	Papua New Guinea	146.0	154.8	25.639
EAP	Southeast Asia	Philippines	94.8	227.8	6.462
EAP	Southeast Asia	Thailand	47.7	312.2	21.075
EAP	Southeast Asia	Viet Nam	-48.7	85.3	1743.894
ECA	Eastern Europe	Albania	0.8	4.6	62.344
ECA	Eastern Europe	Armenia	0.0	6.6	
ECA	Eastern Europe	Belarus	5.6	84.3	0.000
ECA	Eastern Europe	Bosnia and Herzegovina	0.0	16.6	0.014
ECA	Eastern Europe	Bulgaria	-2.0	59.8	16.861
ECA	Eastern Europe	Croatia	-0.2	25.9	58.026
ECA	Eastern Europe	Czech Rep	0.0	143.0	1.291
ECA	Eastern Europe	Estonia	2.2	24.9	7.914
ECA	Eastern Europe	Georgia	0.0	10.2	
ECA	Eastern Europe	Hungary	-0.7	75.0	0.947
ECA	Eastern Europe	Latvia	3.9	13.5	10.738
ECA	Eastern Europe	Lithuania	3.1	18.0	1.742
ECA	Eastern Europe	Macedonia, FYR	0.0	11.2	
ECA	Eastern Europe	Moldova, Rep	0.0	10.9	
ECA	Eastern Europe	Poland	-1.8	378.8	26.165
ECA	Eastern Europe	Romania	-1.4	123.3	6.758

			Annual CO2 Emissions (Mt)		CO2 Storage Potential / Annual Emissions
Region	Subregion	Country	Deforestation	Total	
ECA	Eastern Europe	Russian Federation	54.2	1969.4	184.646
ECA	Eastern Europe	Serbia and Montenegro	0.1	60.4	3.160
ECA	Eastern Europe	Slovakia	3.0	48.4	0.000
ECA	Eastern Europe	Slovenia	1.1	20.2	0.294
ECA	Eastern Europe	Ukraine	0.0	481.9	
ECA	Middle East	Turkey	20.8	376.2	4.990
ECA	Western Asia	Azerbaijan	0.0	55.4	
ECA	Western Asia	Kazakhstan	0.0	161.0	
ECA	Western Asia	Kyrgyzstan	0.0	7.1	
ECA	Western Asia	Tajikistan	0.0	8.2	
ECA	Western Asia	Turkmenistan	0.0	64.1	
ECA	Western Asia	Uzbekistan	0.0	180.8	
LCR	Andean South America	Bolivia	83.8	123.2	50.290
LCR	Andean South America	Colombia	106.1	266.4	21.291
LCR	Andean South America	Ecuador	58.9	100.8	39.057
LCR	Andean South America	Peru	187.2	257.0	18.022
LCR	Caribbean Islands	Antigua and Barbuda	0.0	1.3	
LCR	Caribbean Islands	Barbados	0.0	1.5	
LCR	Caribbean Islands	Dominica	0.0	0.2	
LCR	Caribbean Islands	Dominican Rep	0.0	30.8	11.751
LCR	Caribbean Islands	Grenada	0.0	0.3	
LCR	Caribbean Islands	Haiti	2.0	9.4	34.402
LCR	Caribbean Islands	Jamaica	2.6	15.6	18.799
LCR	Caribbean Islands	Saint Kitts and Nevis	0.0	0.1	
LCR	Caribbean Islands	St. Lucia	0.0	0.5	
LCR	Caribbean Islands	St. Vincent & Grenadines	0.0	0.2	
LCR	Caribbean Islands	Trinidad and Tobago	0.0	24.9	
LCR	Central America	Belize	21.4	22.6	1.487
LCR	Central America	Costa Rica	9.9	22.4	35.609
LCR	Central America	El Salvador	4.1	15.5	9.257
LCR	Central America	Guatemala	56.6	78.1	1.600
LCR	Central America	Honduras	17.6	31.1	10.459
LCR	Central America	Mexico	96.9	608.7	40.338
LCR	Central America	Nicaragua	53.7	66.7	4.212
LCR	Central America	Panama	47.5	59.3	5.880
LCR	Northern South America	Brazil	1372.1	2223.2	7.367
LCR	Northern South America	Guyana	34.9	38.7	6.962
LCR	Northern South America	Suriname	0.0	3.4	111.568
LCR	Northern South America	Venezuela	144.1	383.6	169.167
LCR	Southern South America	Argentina	55.1	344.5	30.757
LCR	Southern South America	Chile	15.5	91.9	98.527
LCR	Southern South America	Paraguay	20.6	46.7	0.000
LCR	Southern South America	Uruguay	-24.4	1.1	
MNA	Middle East	Iraq	0.2	101.1	368.695

			Annual CO2 Emissions (Mt)		CO2 Storage Potential / Annual Emissions
Region	Subregion	Country	Deforestation	Total	
MNA	Middle East	Jordan	0.1	23.9	0.029
MNA	Middle East	Lebanon	0.6	18.7	5.642
MNA	Middle East	Oman	0.0	29.2	329.315
MNA	Middle East	Syrian Arab Rep	0.1	66.8	40.215
MNA	Middle East	West Bank and Gaza			
MNA	Middle East	Yemen	0.4	25.8	458.871
MNA	North Africa	Algeria	2.8	128.8	271.094
MNA	North Africa	Egypt	3.0	180.5	96.663
MNA	North Africa	Libyan Arab Jamahiriya	0.7	62.5	350.286
MNA	North Africa	Morocco	2.6	59.8	95.252
MNA	North Africa	Tunisia	3.9	34.6	53.348
MNA	Western Asia	Iran, Islamic Rep	8.1	488.4	423.841
OTHER	Atlantic Islands	Channel Islands			
OTHER	Atlantic Islands	Faeroe Islands			
OTHER	Atlantic Islands	Greenland			
OTHER	Atlantic Islands	Iceland	0.0	2.8	
OTHER	Atlantic Islands	Isle of Man			
OTHER	AustraliaNZ	Australia	4.2	495.1	145.099
OTHER	AustraliaNZ	New Zealand	3.2	76.1	281.966
OTHER	Caribbean Islands	Aruba			
OTHER	Caribbean Islands	Bahamas	0.0	2.0	341.840
OTHER	Caribbean Islands	Bermuda			
OTHER	Caribbean Islands	Cayman Islands			
OTHER	Caribbean Islands	Cuba	-8.9	41.2	14.392
OTHER	Caribbean Islands	Netherlands Antilles			
OTHER	Caribbean Islands	Puerto Rico			
OTHER	Caribbean Islands	Virgin Islands			
OTHER	Indian Ocean Islands	Mayotte			
OTHER	Middle East	Bahrain	0.0	16.6	34.330
OTHER	Middle East	Israel	0.1	77.4	1.979
OTHER	Middle East	Kuwait	0.0	69.1	347.268
OTHER	Middle East	Qatar	0.0	39.7	3585.906
OTHER	Middle East	Saudi Arabia	0.0	340.6	243.650
OTHER	Middle East	United Arab Emirates	0.0	117.2	
OTHER	North America	Canada	64.5	744.7	72.956
OTHER	North America	United States	-402.9	6525.2	14.579
OTHER	Northeast Asia	Japan	4.3	1321.0	1.649
OTHER	Northeast Asia	Korea, Dem People's Rep	1.0	112.8	6.353
OTHER	Northeast Asia	Taiwan	0.0	230.4	
OTHER	Pacific Islands	American Samoa			
OTHER	Pacific Islands	Cook Islands	0.0	0.0	0.000
OTHER	Pacific Islands	French Polynesia			
OTHER	Pacific Islands	Guam			
OTHER	Pacific Islands	Nauru	0.0	0.2	

			Annual CO2 Emissions (Mt)		CO2 Storage Potential / Annual Emissions
Region	Subregion	Country	Deforestation	Total	
OTHER	Pacific Islands	New Caledonia			
OTHER	Pacific Islands	Niue	0.0	0.0	
OTHER	Pacific Islands	Northern Mariana Islands			
OTHER	Pacific Islands	Tuvalu			
OTHER	Southeast Asia	Brunei Darussalam	0.0	7.3	
OTHER	Southeast Asia	Singapore	0.1	55.9	0.007
OTHER	Western Europe	Andorra			
OTHER	Western Europe	Austria	-0.8	79.6	0.000
OTHER	Western Europe	Belgium	0.0	148.2	
OTHER	Western Europe	Cyprus	0.1	8.0	9.768
OTHER	Western Europe	Denmark	-0.1	66.4	38.008
OTHER	Western Europe	Finland	-0.8	67.7	1.056
OTHER	Western Europe	France	-6.1	507.3	2.692
OTHER	Western Europe	Germany	0.0	1009.4	3.214
OTHER	Western Europe	Gibraltar			
OTHER	Western Europe	Greece	-3.0	117.0	6.175
OTHER	Western Europe	Ireland	-1.7	64.1	7.903
OTHER	Western Europe	Italy	-3.0	528.1	6.537
OTHER	Western Europe	Liechtenstein			
OTHER	Western Europe	Luxembourg	0.0	9.2	
OTHER	Western Europe	Malta	0.0	2.4	17.981
OTHER	Western Europe	Monaco			
OTHER	Western Europe	Netherlands	-0.1	215.0	88.731
OTHER	Western Europe	Norway	-3.1	50.7	1043.731
OTHER	Western Europe	Portugal	-5.8	73.4	20.732
OTHER	Western Europe	San Marino			
OTHER	Western Europe	Spain	-8.7	372.4	2.706
OTHER	Western Europe	Sweden	-0.1	61.8	2.355
OTHER	Western Europe	Switzerland	-0.4	51.1	0.000
OTHER	Western Europe	United Kingdom	-1.7	652.0	18.370
SAR	Indian Ocean Islands	Maldives	0.0	0.6	
SAR	Southern Asia	Bangladesh	-9.3	113.1	177.582
SAR	Southern Asia	Bhutan	0.0	1.9	0.000
SAR	Southern Asia	India	-40.3	1843.8	24.146
SAR	Southern Asia	Nepal	123.5	155.1	0.000
SAR	Southern Asia	Sri Lanka	29.5	57.6	68.121
SAR	Western Asia	Afghanistan	8.8	31.0	0.000
SAR	Western Asia	Pakistan	33.0	318.4	60.496

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS4280	Governance Matters VI: Aggregate and Individual Governance: Indicators, 1996-2006	Daniel Kaufmann Aart Kraay Massimo Mastruzzi	July 2007	R. Bonfield 31248
WPS4281	Credit Growth In Emerging Europe: A Cause For Stability Concerns?	Sophie Sirtaine Ilias Skamnelos	July 2007	S. Sirtaine 87006
WPS4282	Are Cash Transfers Made to Women Spent Like Other Sources of Income	Norbert Schady José Rosero	July 2007	I. Hafiz 37851
WPS4283	Innovation Shortfalls	William Maloney Andrés Rodríguez-Clare	July 2007	V. Cornago 84039
WPS4284	Customer Market Power and the Provision of Trade Credit: Evidence from Eastern Europe and Central Asia	Neeltje Van Horen	July 2007	M. Gamboa 34847
WPS4285	Poverty Analysis Using An International Cross-Country Demand System	J. A. L. Cranfield Paul V. Preckel Thomas W. Hertel	July 2007	P. Flewitt 32724
WPS4286	Institutional Effects as Determinants of Learning Outcomes: Exploring State Variations in Mexico	Jesús Álvarez Vicente García Moreno Harry Anthony Patrinos	July 2007	S. Baksh 31085
WPS4287	A Cross-Country Analysis of Public Debt Management Strategies	Martin Meleckyy	July 2007	M. Rosenquist 82602
WPS4288	Actual Crop Water Use in Project Countries A Synthesis at the Regional Level	Robina Wahaj Florent Maraux Giovanni Munoz	July 2007	P. Kokila 33716
WPS4289	Sensitivity of Cropping Patterns in Africa to Transient Climate Change	Alexander Lotsch	July 2007	P. Kokila 33716
WPS4290	The Impacts of Climate Change on Regional Water Resources and Agriculture in Africa	Kenneth Strzepek Alyssa McCluskey	July 2007	P. Kokila 33716
WPS4291	An Empirical Economic AssessmentOf Impacts Of Climate Change On Agriculture In Zambia	Suman Jain	July 2007	P. Kokila 33716
WPS4292	Assessment of the Economic Impacts of Climate Change on Agriculture in Zimbabwe: A Ricardian Approach	Reneth Mano Charles Nhemachena	July 2007	P. Kokila 33716
WPS4293	Assessing the Economic Impacts of Climate Change on Agriculture in Egypt: A Ricardian Approach	Helmy M. Eid Samia M. El-Marsafawy Samiha A. Ouda	July 2007	P. Kokila 33716
WPS4294	Scarperation: An Empirical Inquiry into The Role of Scarcity in Fostering Cooperation Between International River Riparian	Shlomi Dinar Ariel Dinar Pradeep Kurukulasuriya	July 2007	P. Kokila 33716
WPS4295	Economic Benefit of Tuberculosis Control	Ramanan Laxminarayan Eili Klein Christopher Dye Katherine Floyd Sarah Darley Olusoji Adeyi	August 2007	M. Elias 82175

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS4296	When Do Creditor Rights Work?	Mehnaz Safavian Siddharth Sharma	August 2007	S. Narsiah 88768
WPS4297	Big Dragon, Little Dragons: China's Challenge to the Machinery Exports of Southeast Asia	Sjamsu Rahardja	August 2007	K. Shaw 81307
WPS4298	Yield Impact of Irrigation Management Transfer: A Success Story from the Philippines	Sushenjit Bandyopadhyay Priya Shyamsundar Mei Xie	August 2007	A. Sears 82819
WPS4299	Balancing Expenditures on Mitigation of and Adaptation to Climate Change An Exploration of Issues Relevant to Developing Countries	Franck Lecocq Zmarak Shalizi	August 2007	P. Kokila 33716